

NEARSHORE MAPPING OF THE SHOREFACE REGION: LINKING THE INNER SHELF & BEACH SYSTEMS IN SOUTH CAROLINA AND NEW YORK



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US Army
Corps of Engineers



Fire Island New York, Day 3 of Sept 2009 Field Work



CCU BERM System Fire Island National Seashore, NY Sept 2007

Reasons to Avoid Shallow Water Mapping

- *Small Boat Day Ops*
 - *Limited Weather Windows*
 - *Inefficient Survey Days*
- *Shallow Water*
 - *Limited swath coverage*
 - *Acoustically Difficult Environment*
 - *Waves, turbidity, salinity*

Reasons NOT to Avoid Shallow Water Mapping

*Dynamic Nearshore and Inlet Areas
Focus of Pressing Societal Issues*

*Beach Erosion, Inlets, Inlet By-Passing,
Sediment Budgets, Habitats,
Storm Impacts/Recovery*



Recent Shallow Mapping Applications

USGS SC Coastal Erosion Program

Regional Geologic Framework / Coastal Behavior / Modeling

USGS/NPS Fire Island Shoreface

Relationship of Shoreface Ridges and beach erosion patterns

USACOE - Regional Sediment Management

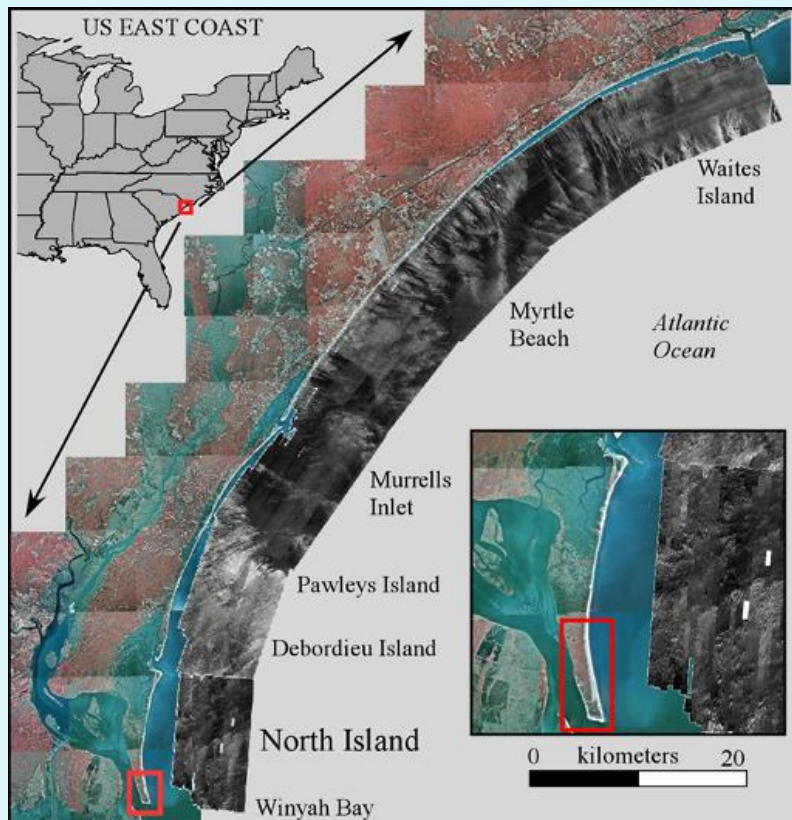
Sediment Budgets / Dispersal Pathways

USGS - SC Sea Grant

SC Coastal Erosion Study

GOAL: To develop a complete understanding of the factors controlling sediment transport in order to predict coastal change.

GOAL: To link inner shelf mapping across to active beach system



Geologic Framework

- Offshore

Side Scan Sonar
Interferometric Sonar
Chirp/uniboom
Surficial Sediment
Vibracores
Bottom Video

- Onshore

Borings
Ground Penetrating Radar

- Link Across the Shoreface

- Shoreline Change

BERM-Long Profiling
Historical Shoreline Change
Beach Cams
"SWASH" Surveys

- Database Integration/Access

ARC-IMS-

- Process Studies



USGS

Coastal Carolina University
Scripps Inst. of Oceanography
College of Charleston
University of South Carolina
Georgia Tech

Skidaway Institute

Georgia Southern Univ.

Cooperative Agencies

MMS, USACE, SC DNR, SC OCRM, NOAA, Counties, Cities, Private Companies

Collaborating Institutions

Univ. S. Florida, Univ. Ill-Chicago, Woods Hole

GEOLOGIC FRAMEWORK

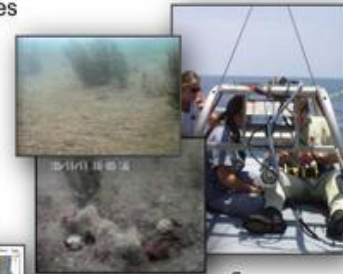
Offshore geologic mapping
large- and small-boat operations



Geologic mapping techniques



Onshore and offshore sampling techniques



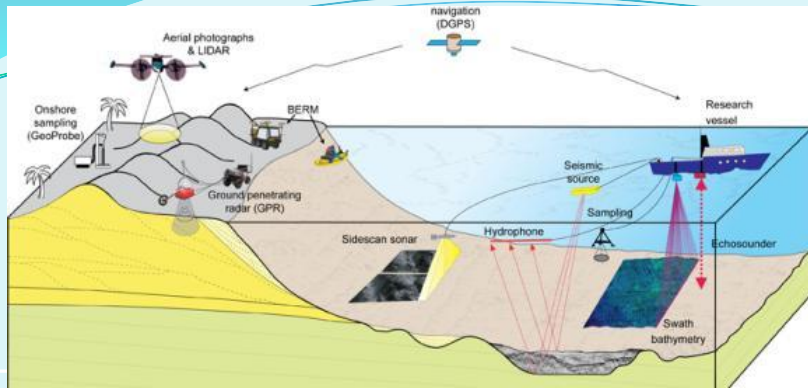
Measuring shoreline change



Measuring sediment transport



MAPPING

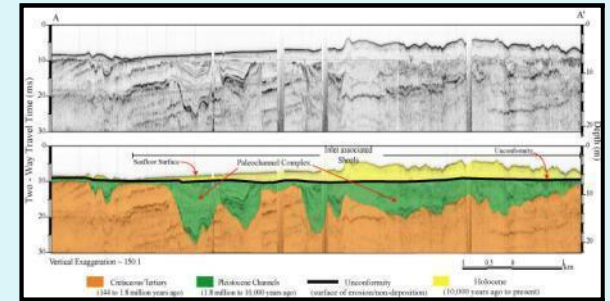
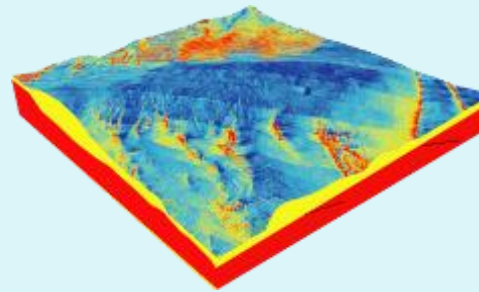
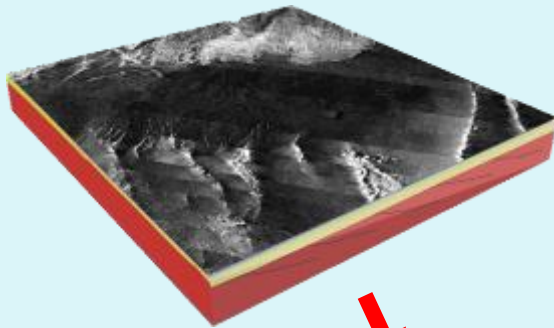


Sidescan Sonar

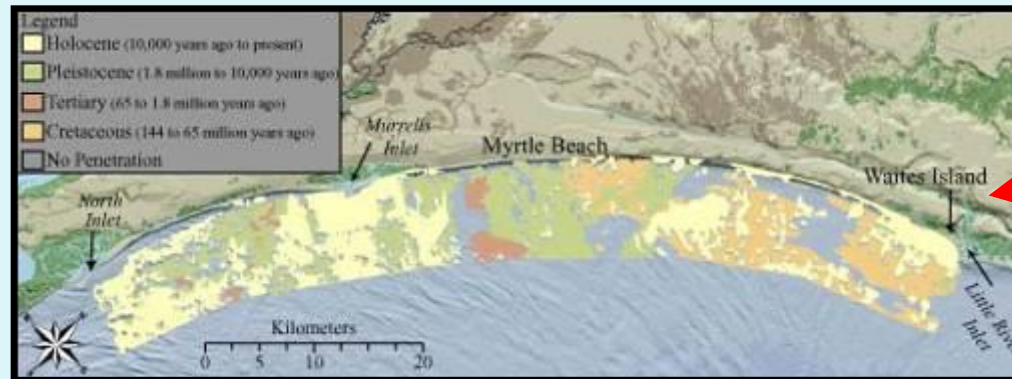
Swath Bathymetry



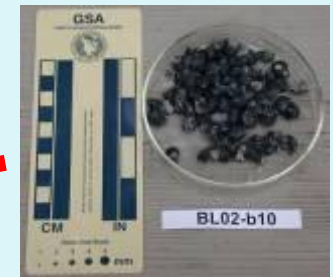
Seismic Reflection



Bottom Photography

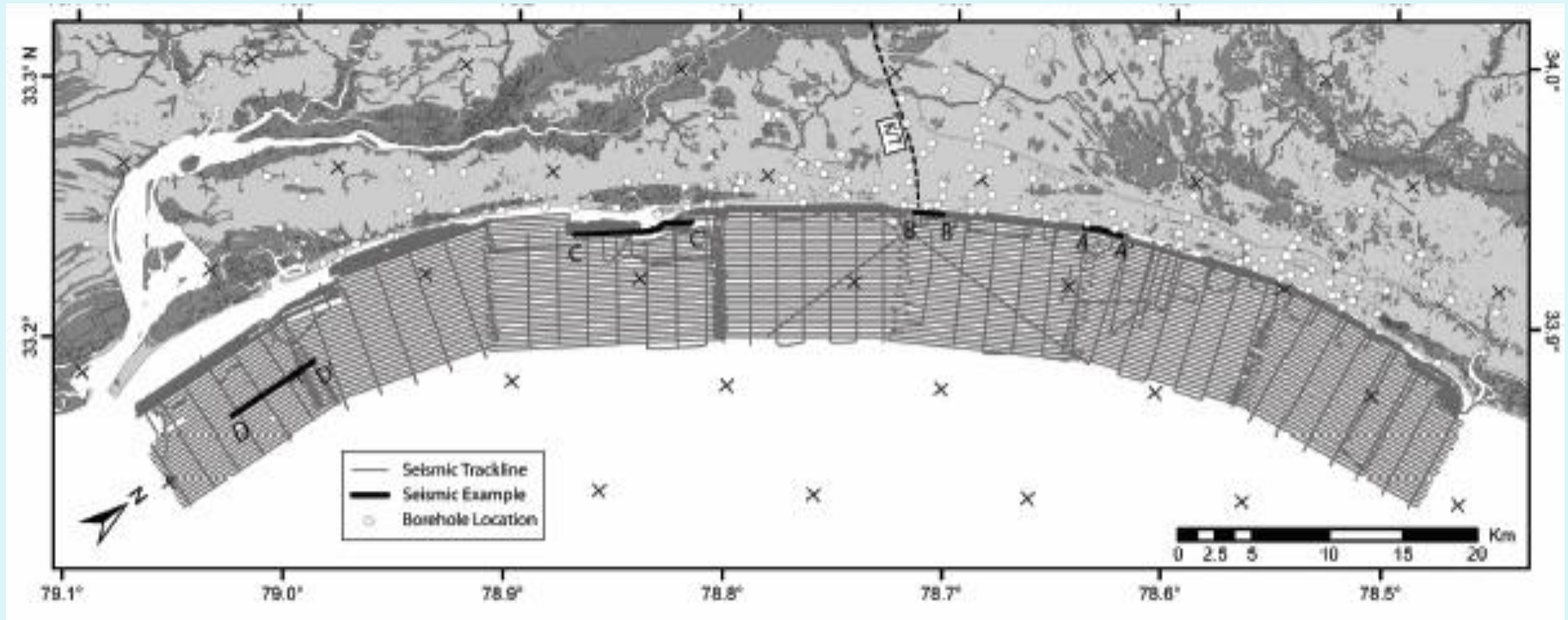


GEOLOGIC MAPS



Core and Grab Samples

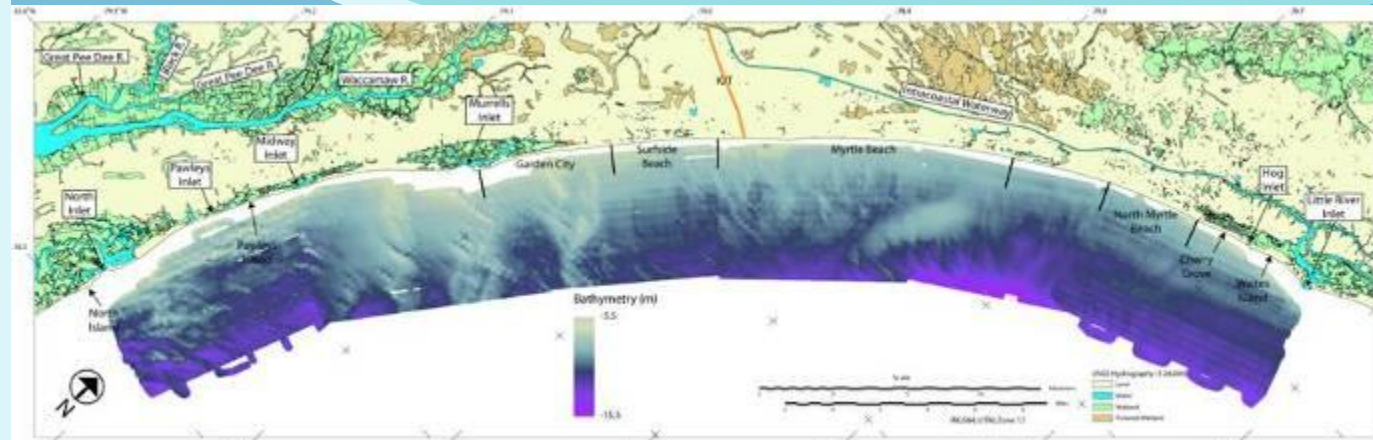
Regional Framework of South Carolina's Grand Strand



USGS Long Bay Geophysical Tracklines
> -7 meters depth

Regional USGS Map Products

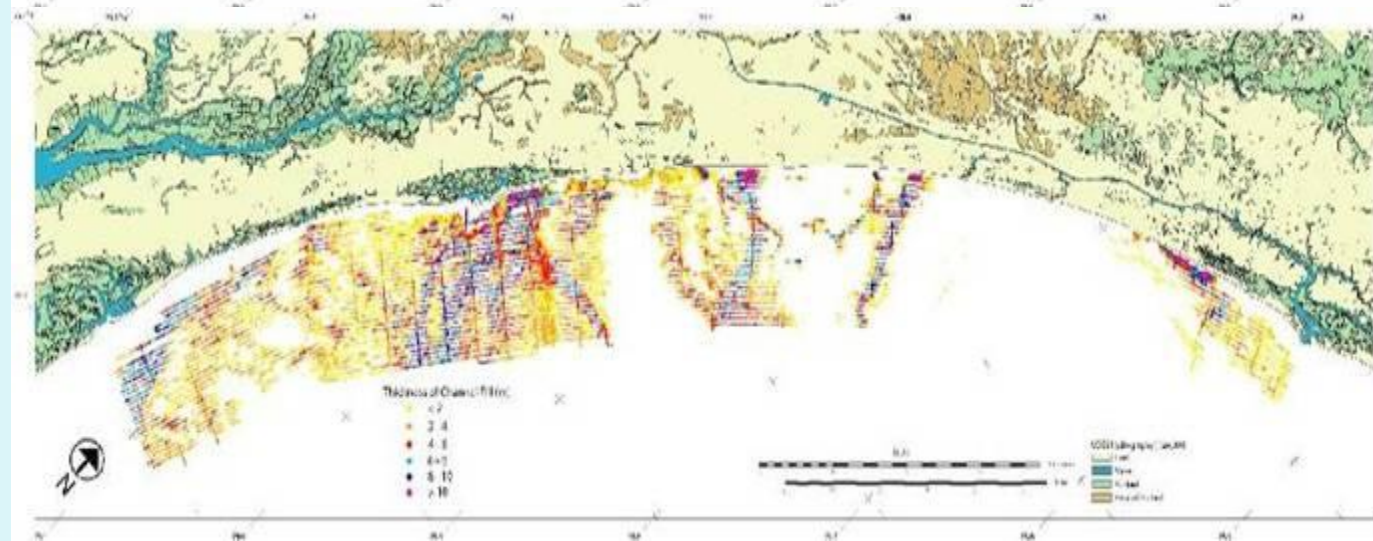
Bathymetry



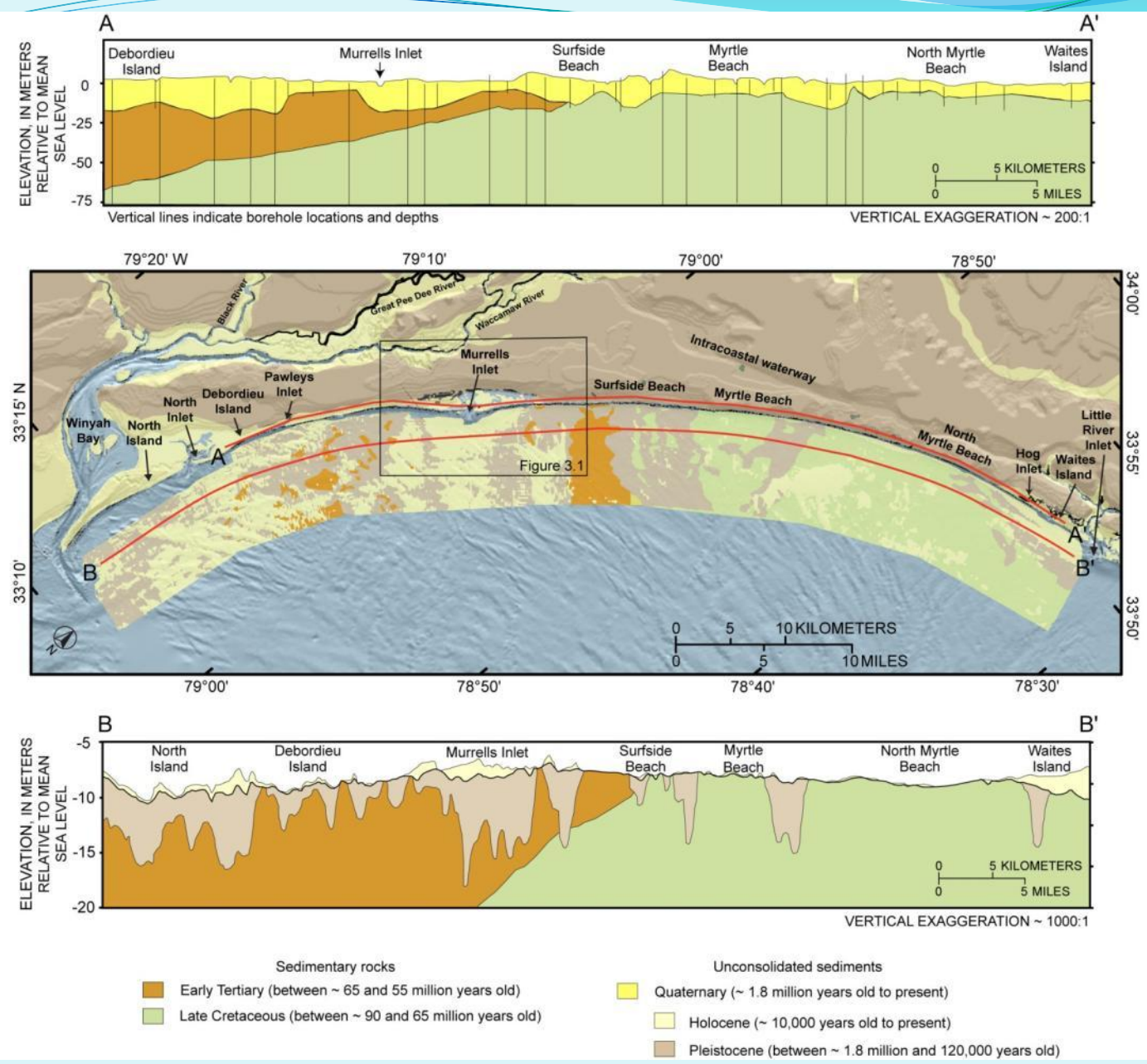
Side Scan Sonar Backscatter



Paleo-drainage

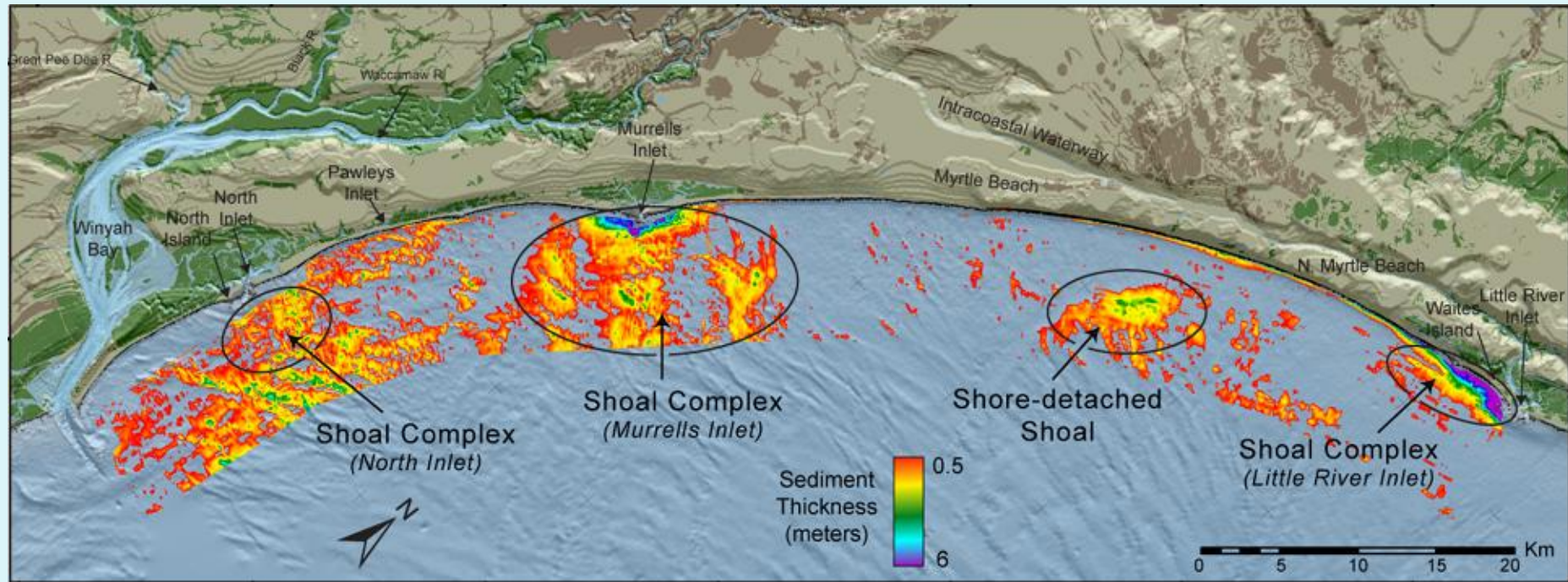


Regional USGS Interpreted Map Products



Applied Data Products

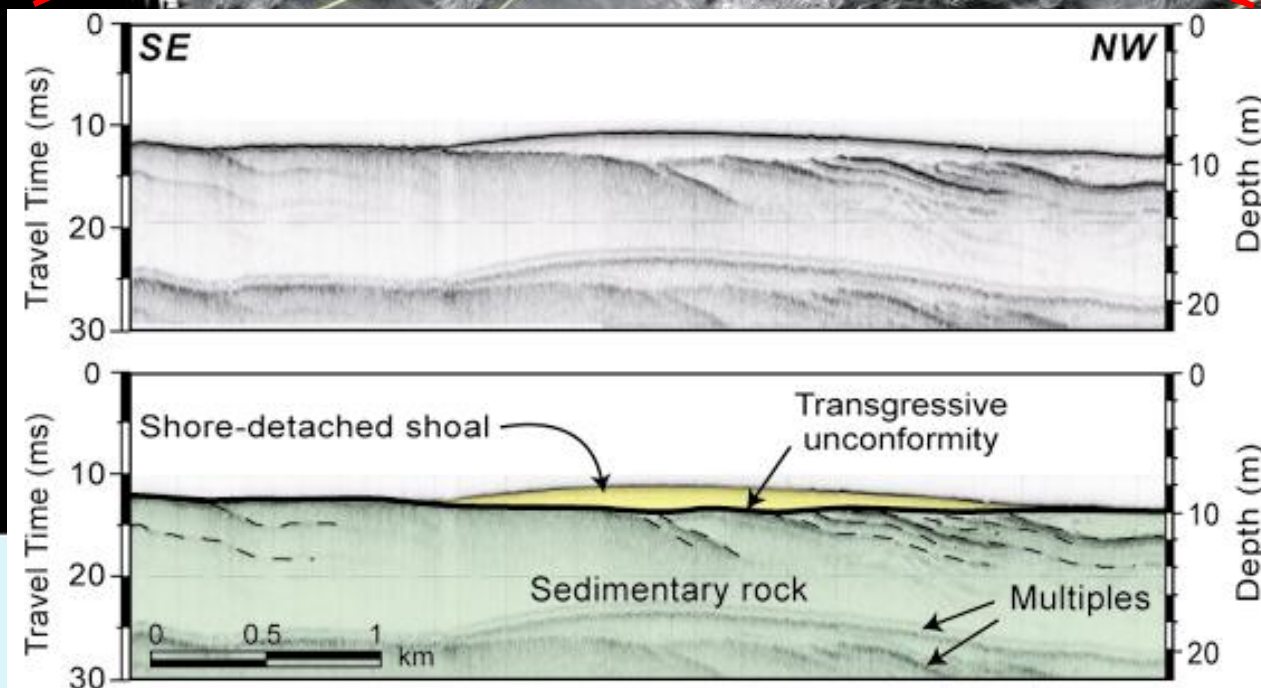
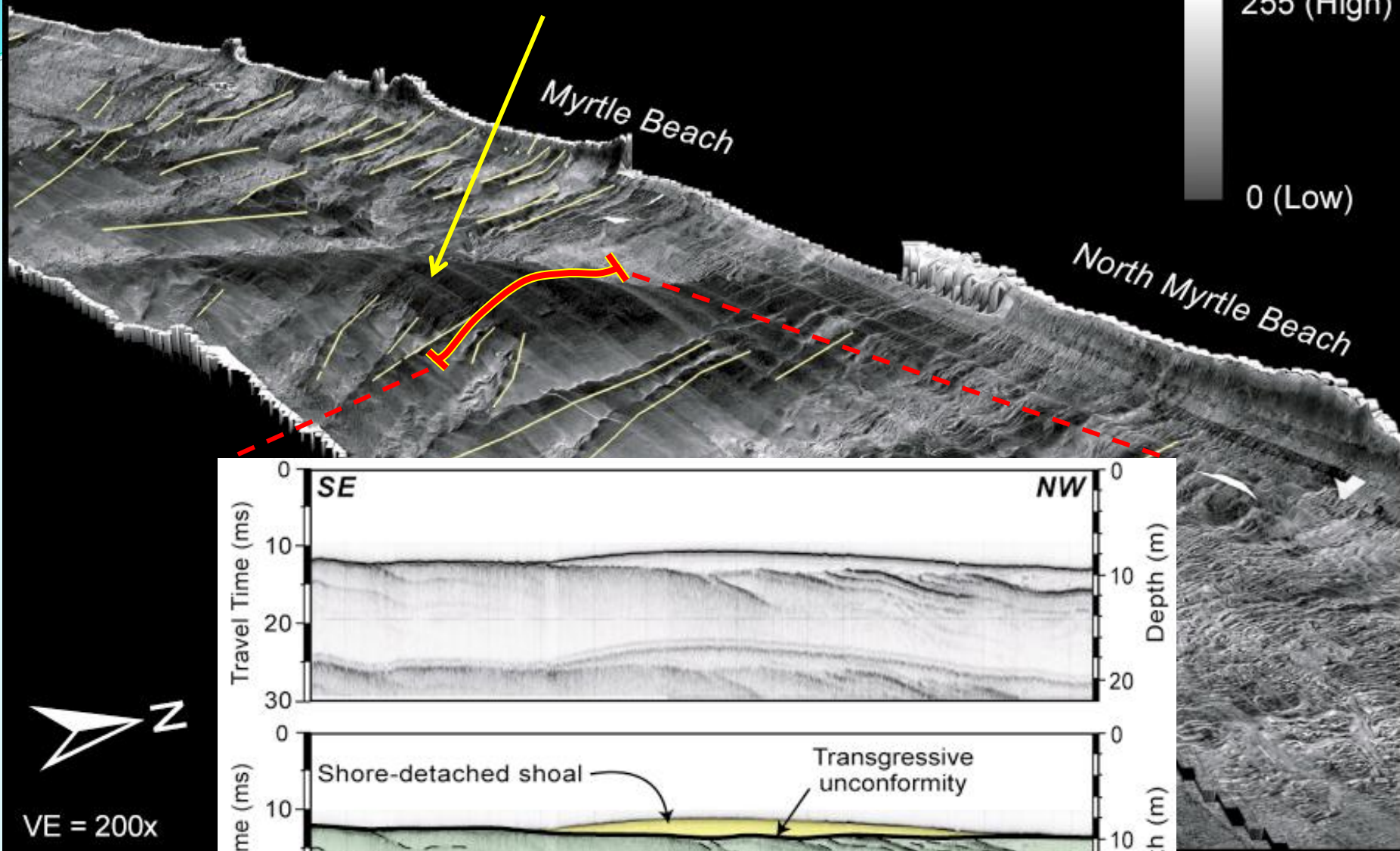
Surficial Sediment Thickness



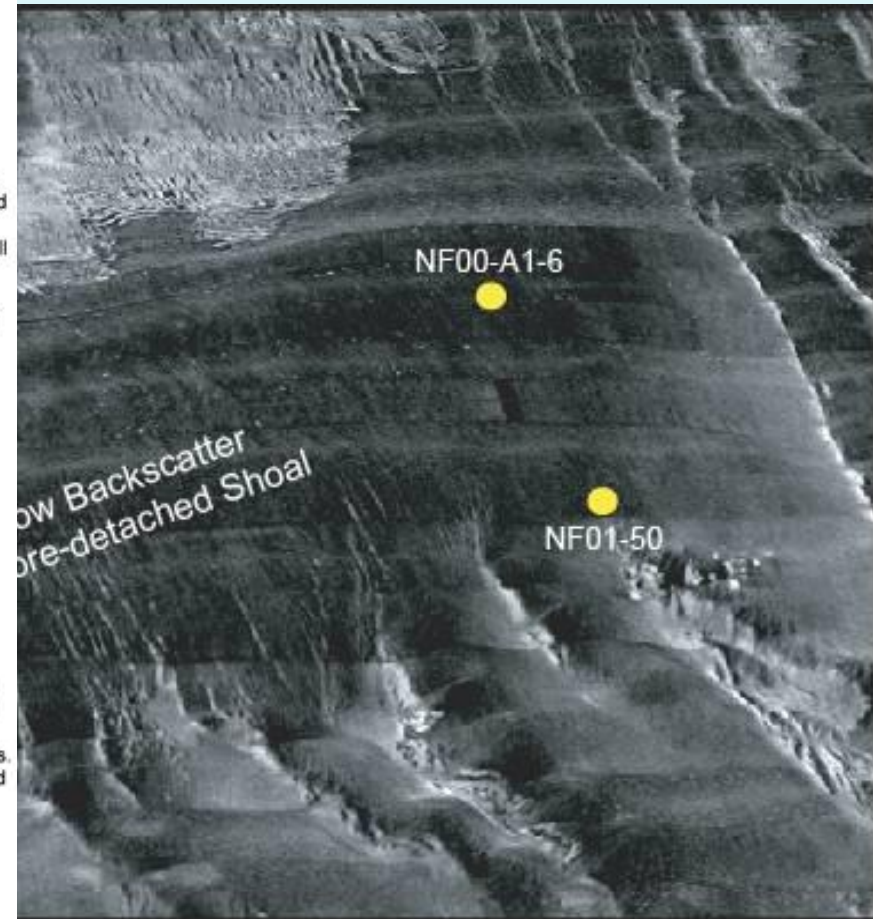
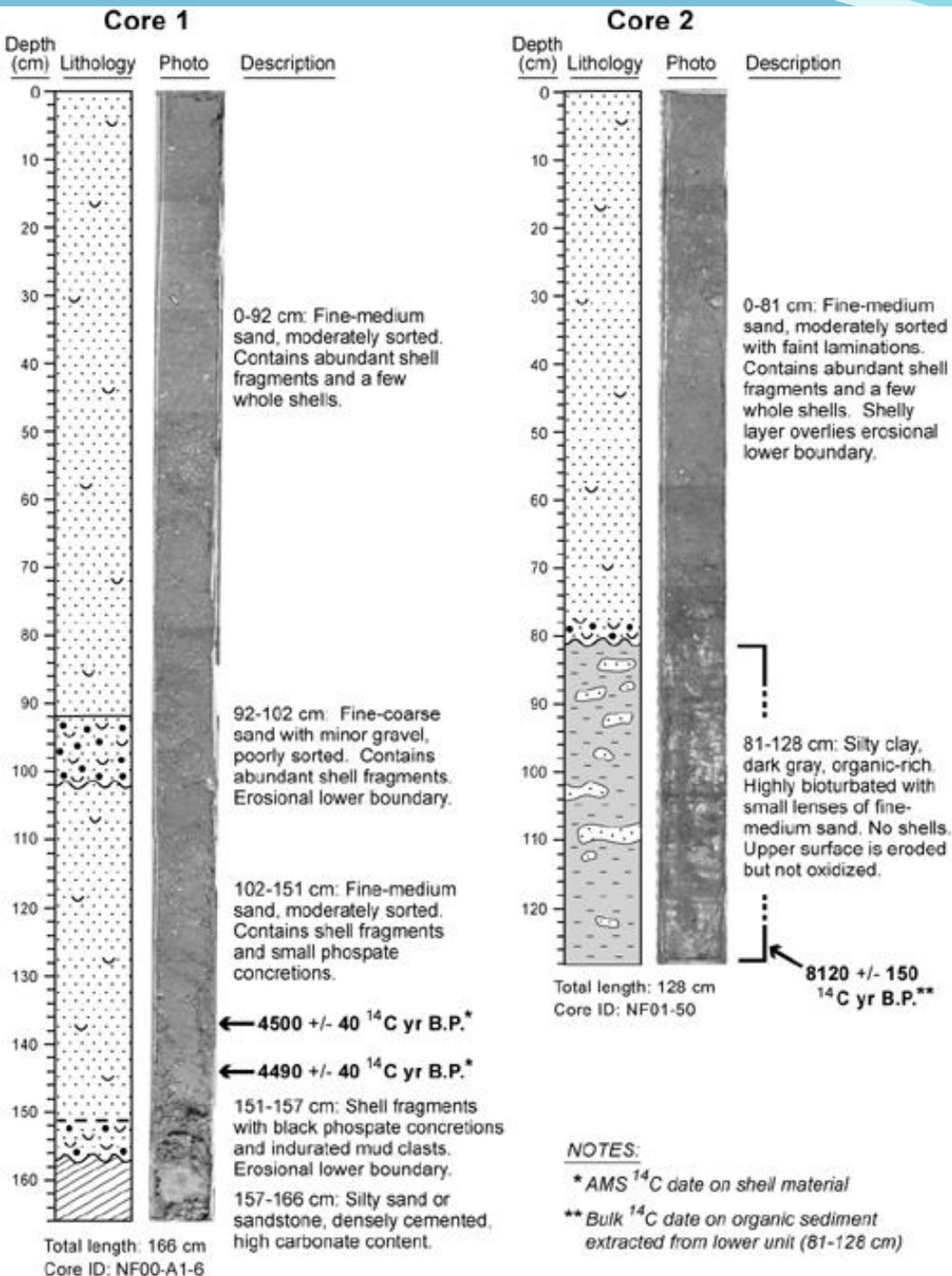
Applications for Resource Management
Beach Nourishment Resources
Critical Habitat Areas
Baseline for Detailed Site Specific Studies

SHORE-DETACHED SHOAL

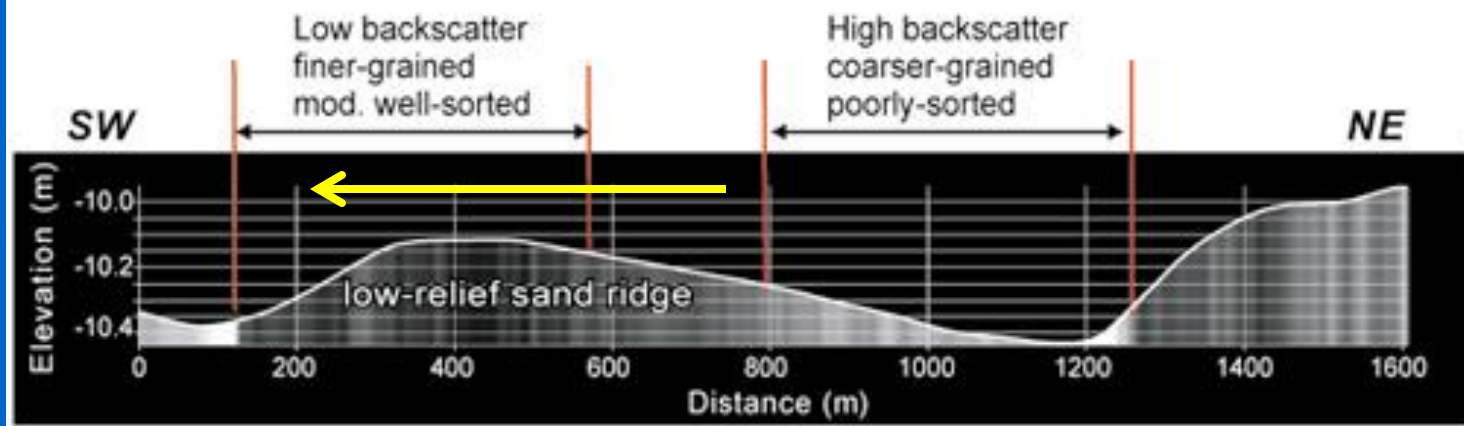
Backscatter
255 (High)
0 (Low)



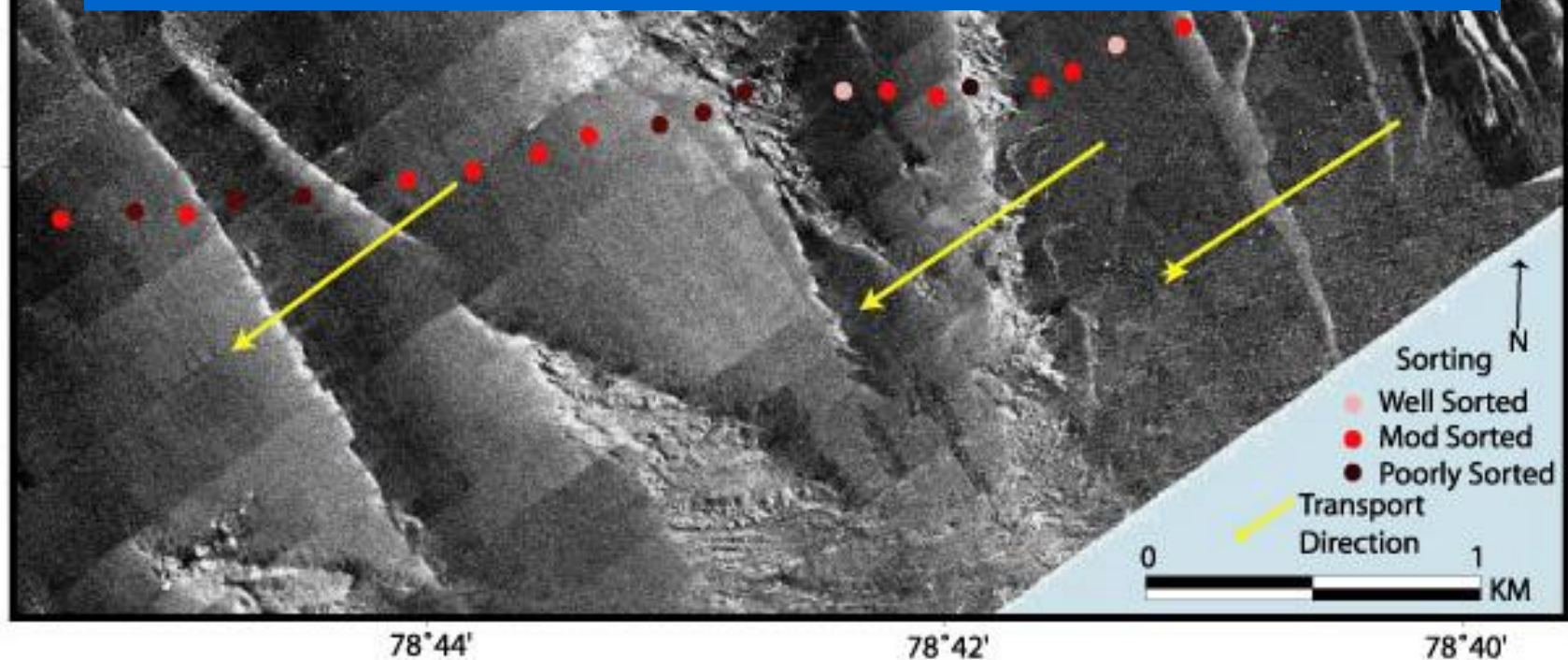
Shore-detached shoal

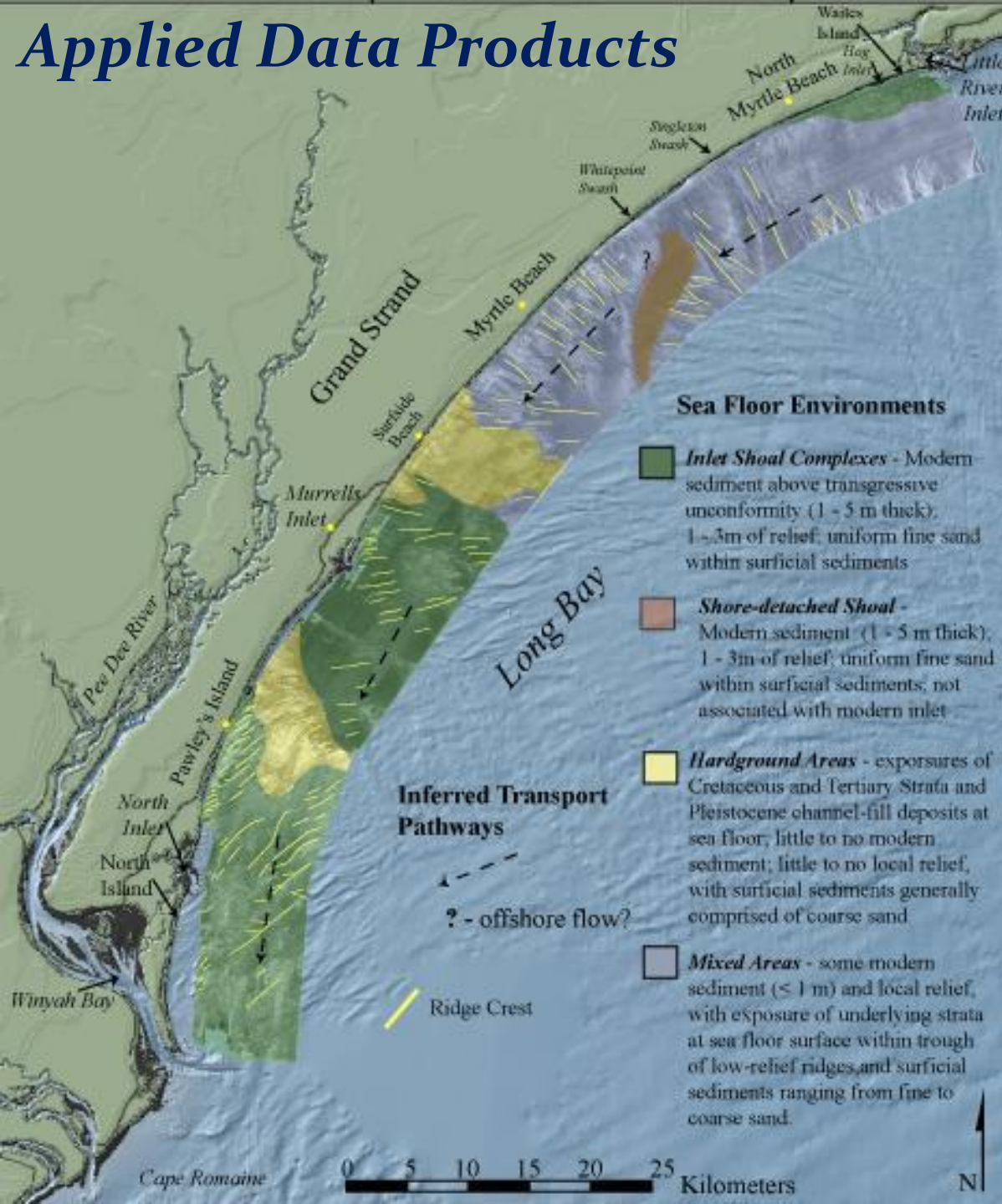


Shells near base of shoal
4810-4540 cal. yr BP



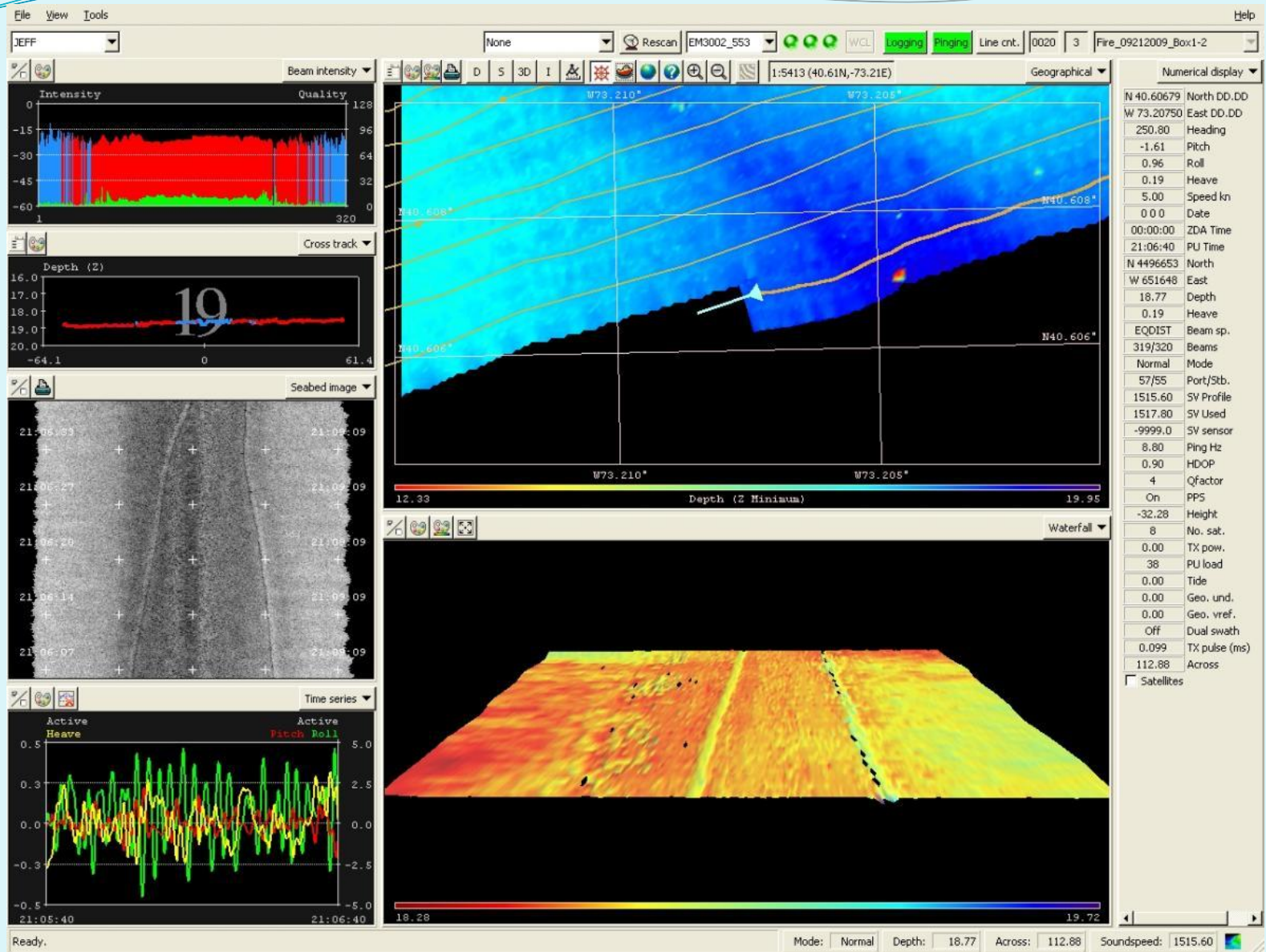
Bedform asymmetry and sediment texture indicates transport is to the ***southwest***





Regional Bottom Habitat Classification

Baseline for Detailed Site Specific Studies

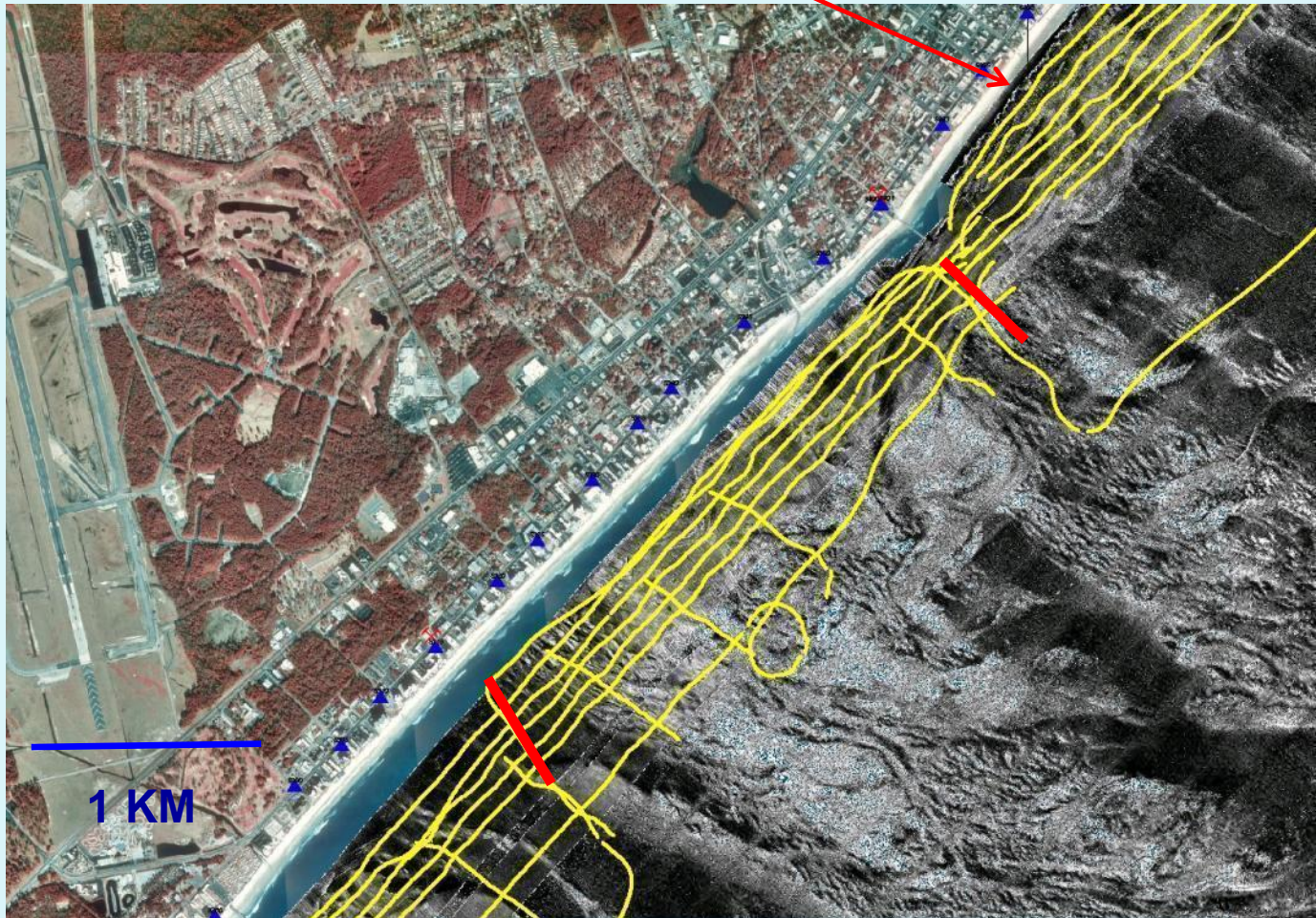


Habitat Disturbance- Trawl Marks

GOAL: Connect Across the Shoreface to the Active Beach System
Area of Primary Concern to State and Local Resource Managers
i.e. Very Shallow Water Mapping

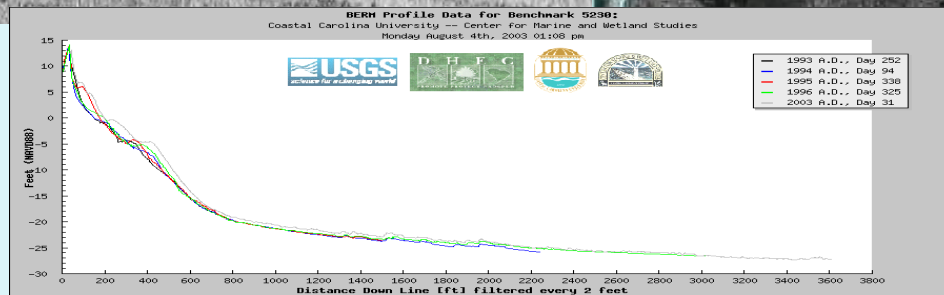
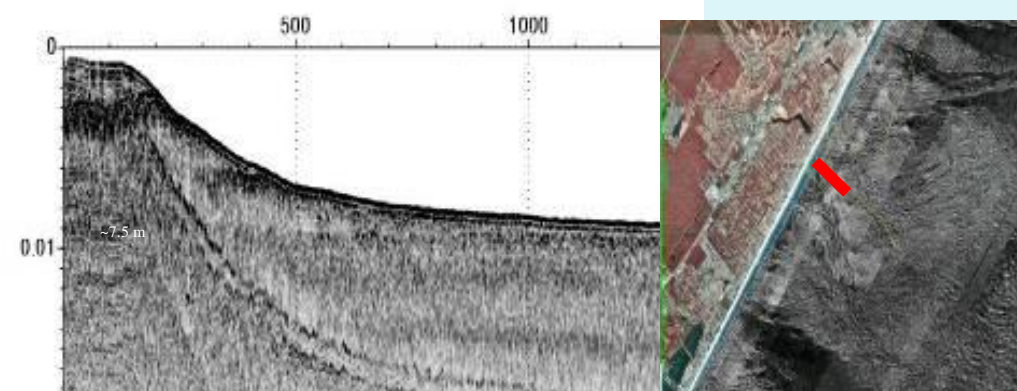
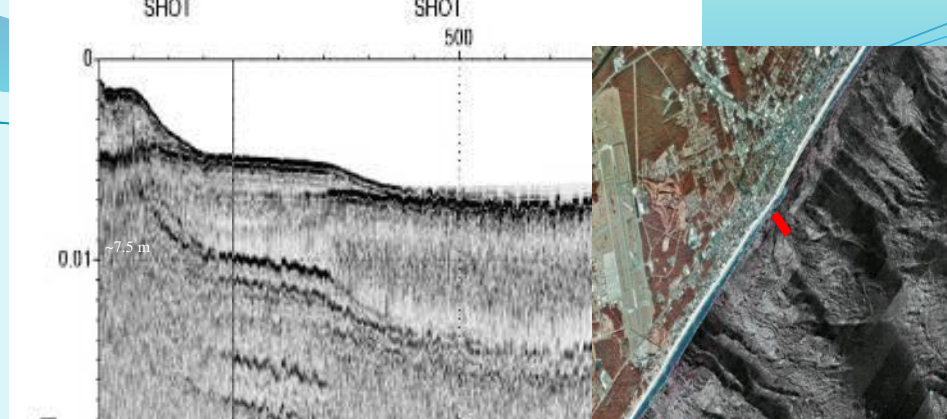
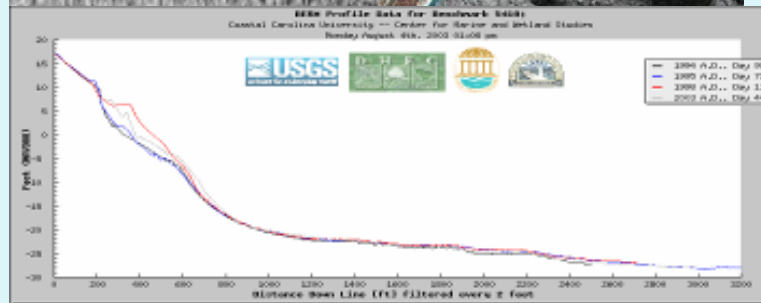
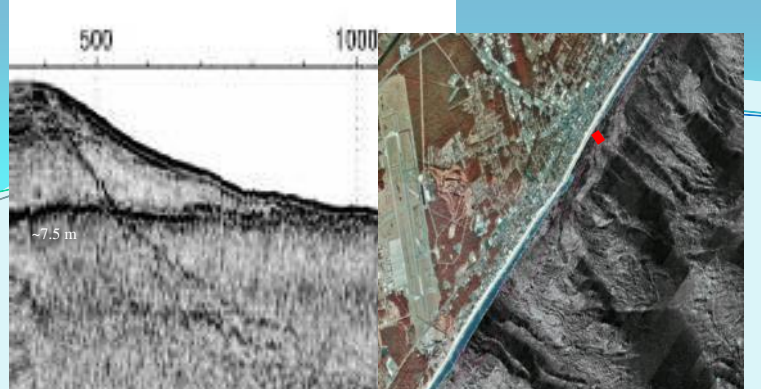


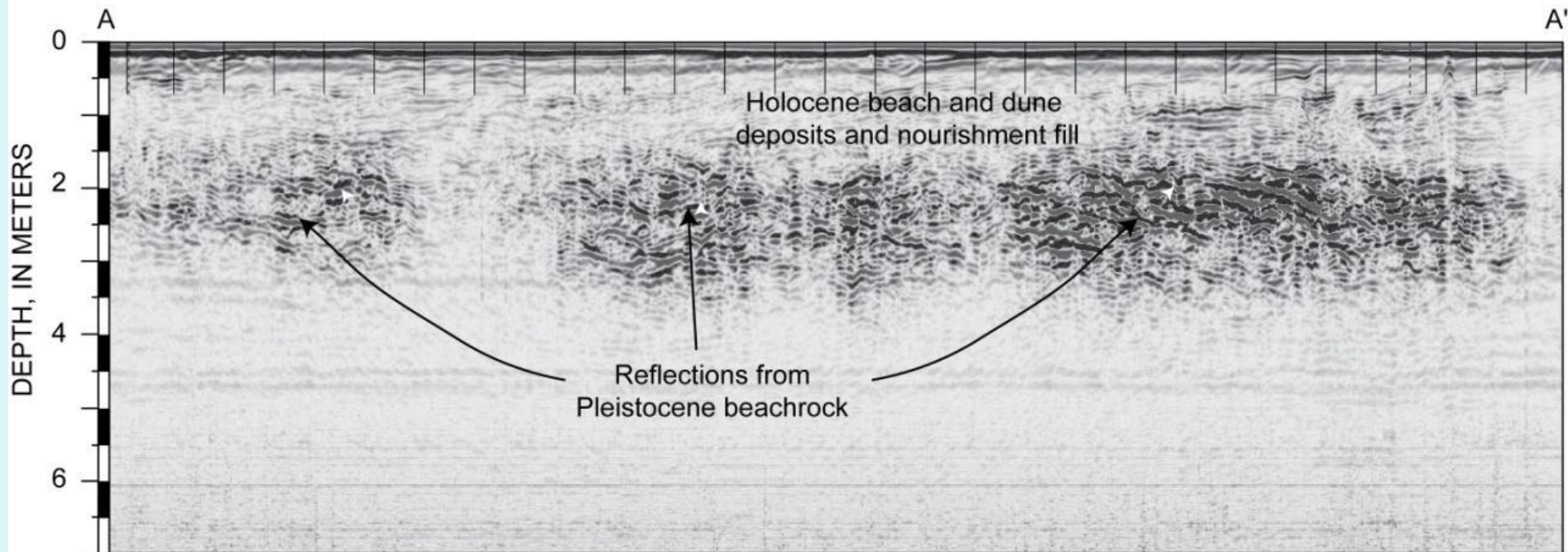
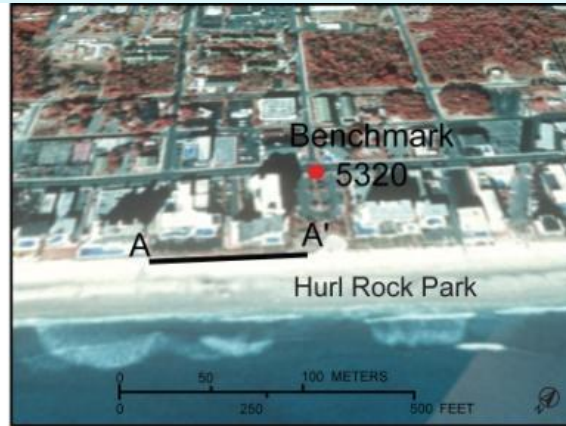
Breakers



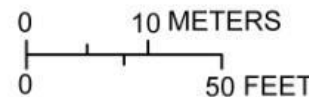
USGS Side Scan Sonar Mosaic

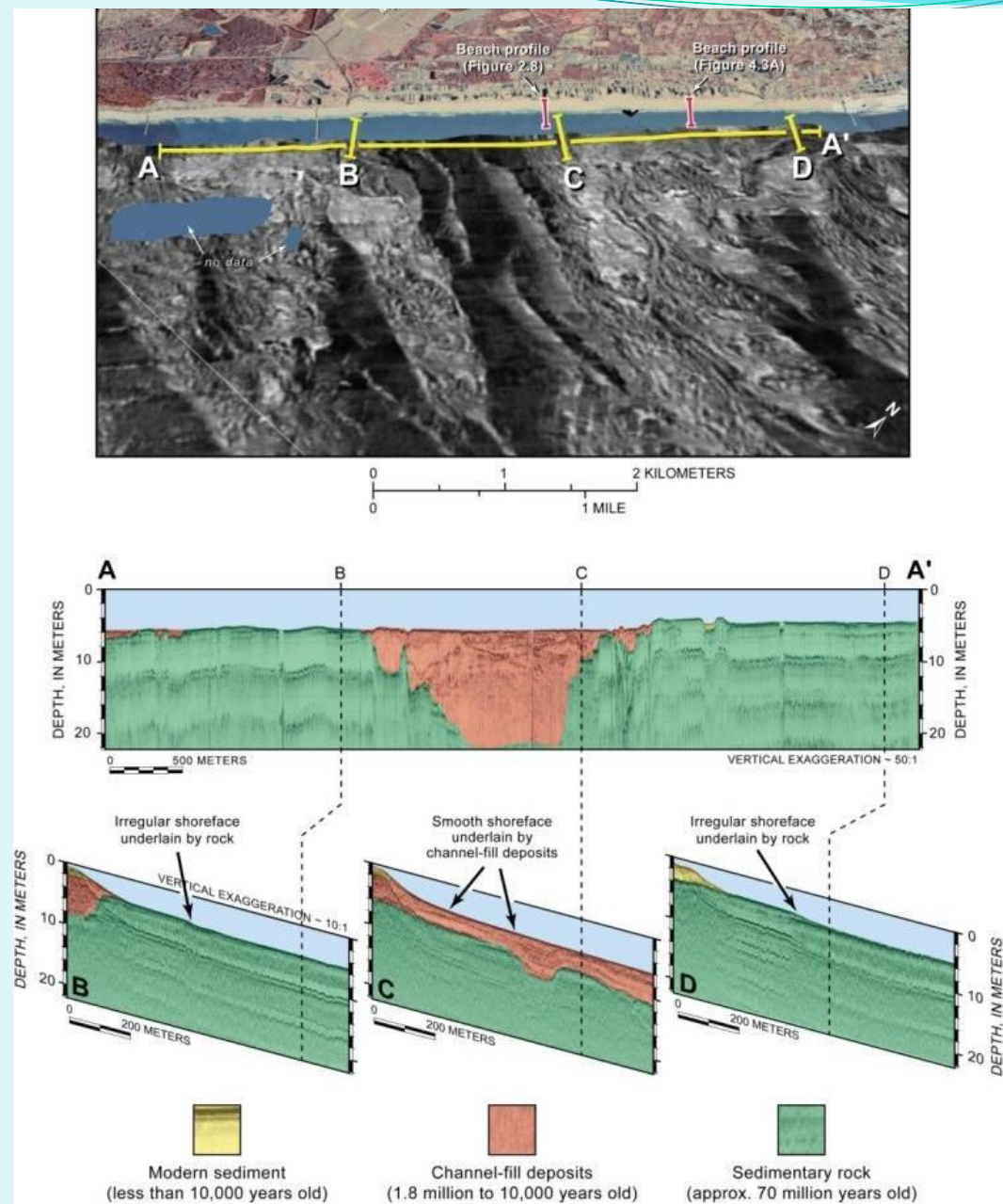
***Connection across the shoreface to active beach
Architecture of the Shoreface and Developing Unconformity Surface
< -7m depth***

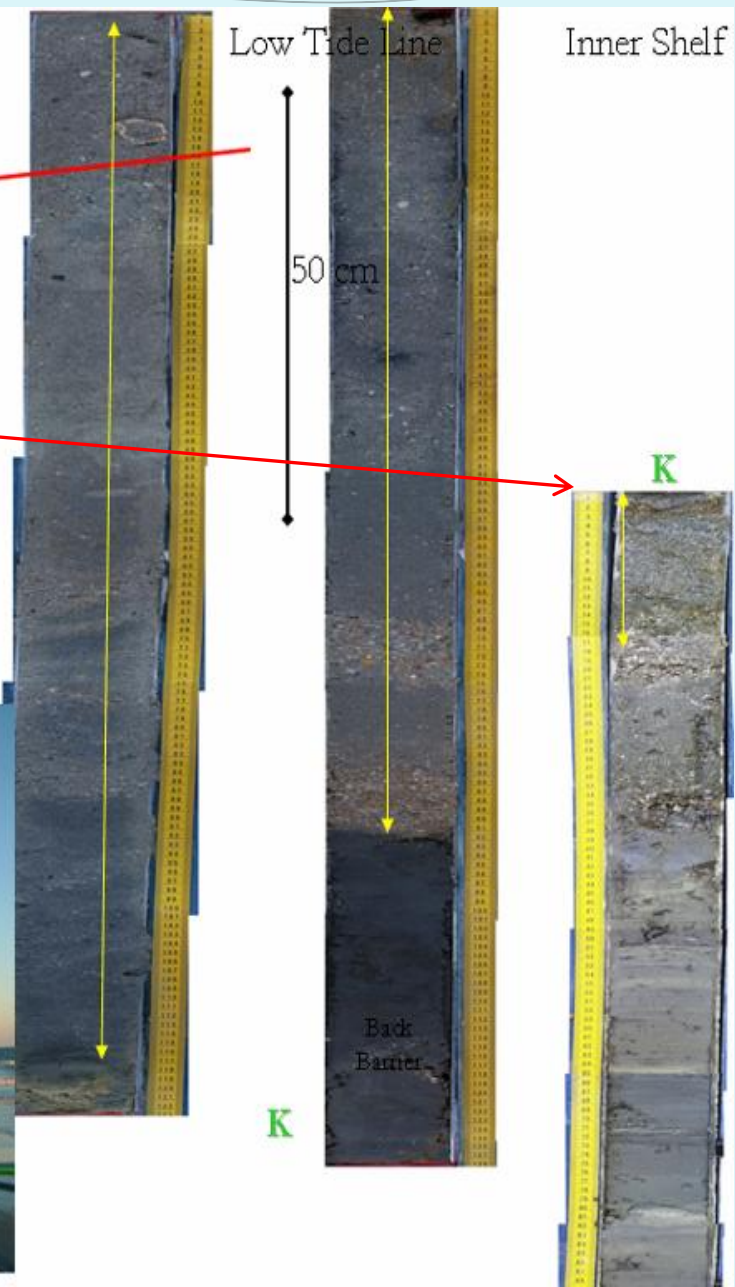
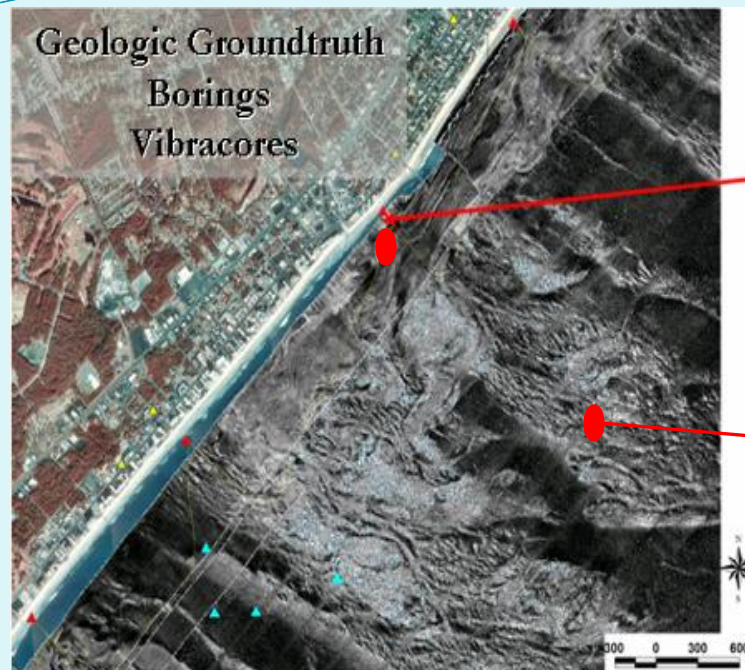


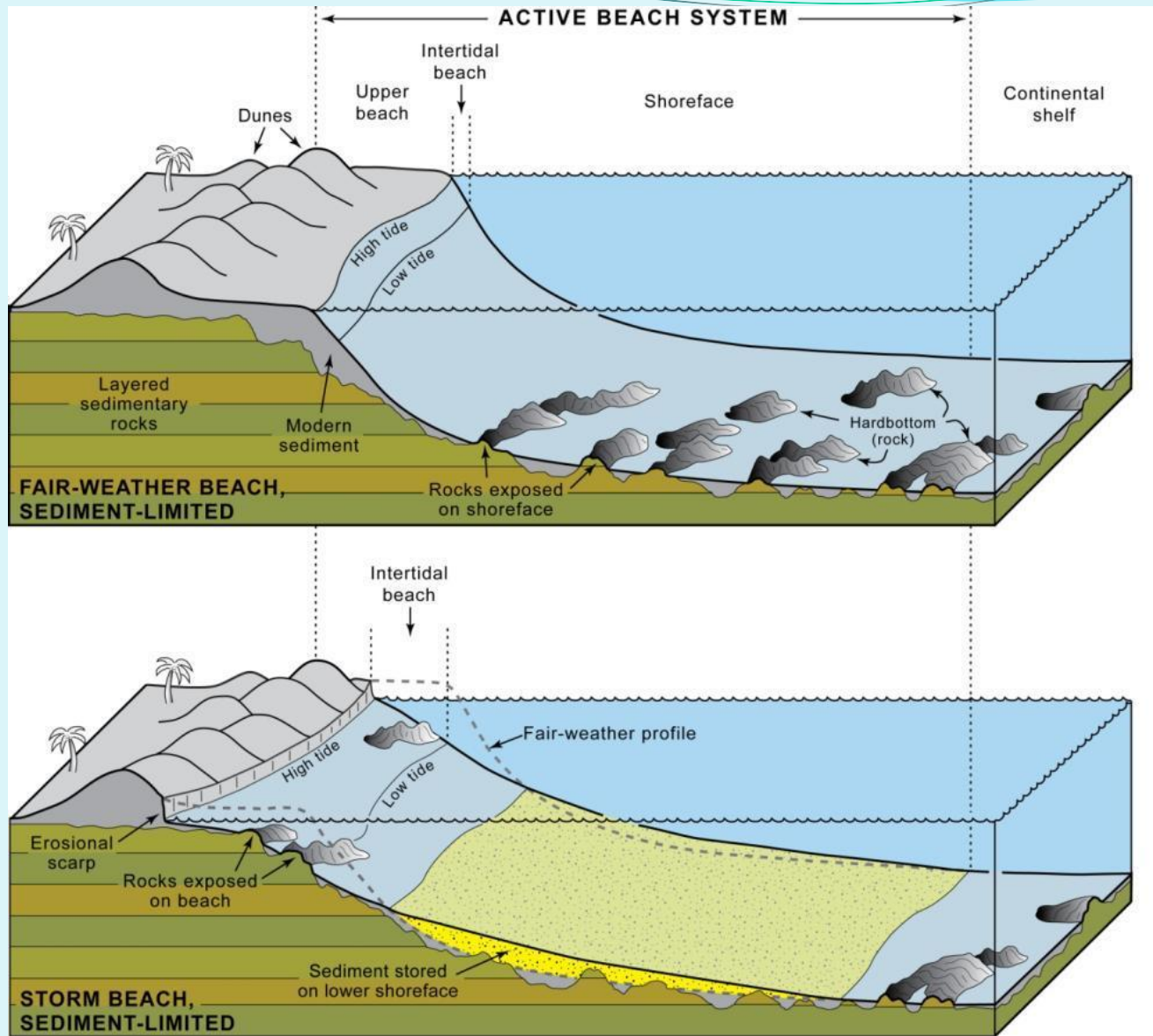


Ground Penetrating Radar of Upper Beach – Courtesy of Illiya Buynevich









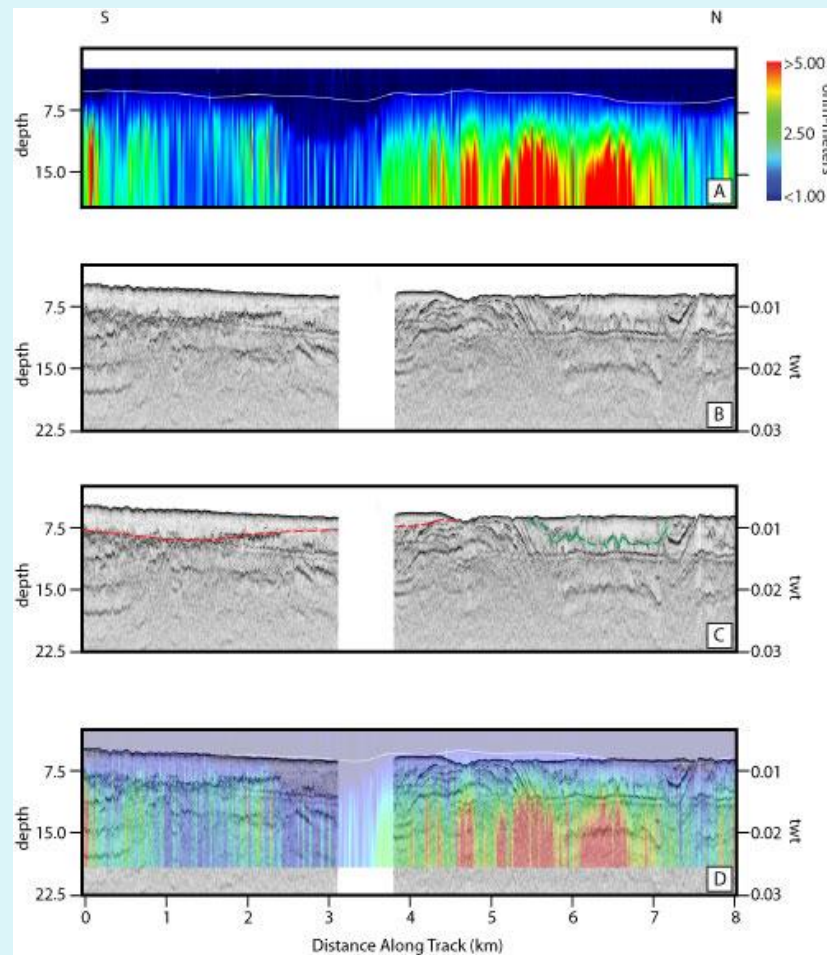
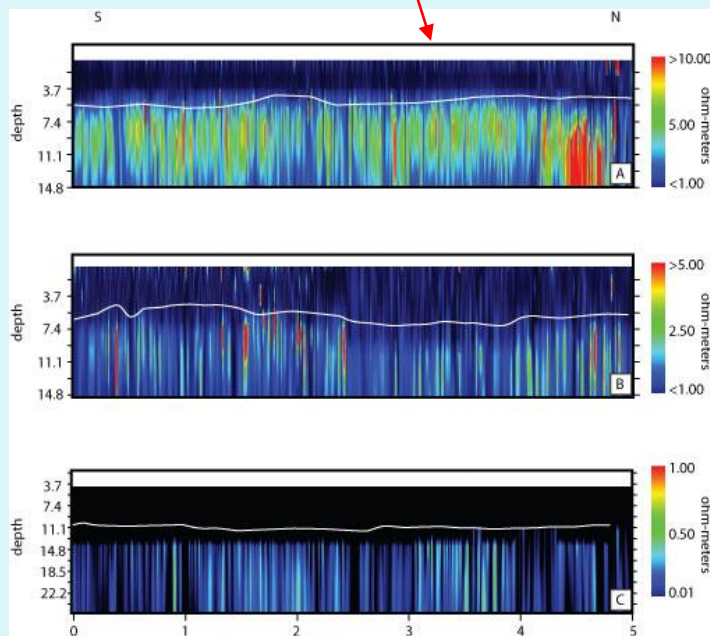
From Barnhardt et al, 2008, *Coastal Change Along the Shore of Northeastern South Carolina: The South Carolina Coastal Erosion Study*; U.S. Geological Survey Open-File Report 2008-1206

Submarine Groundwater Discharge Marine Resistivity Studies



CCU-CMWS CHIRP

*USGS
Resistivity Array
Courtesy of John Bratton; USGS*



Connect Framework to Shoreline Change and Behavior Link to Process Studies



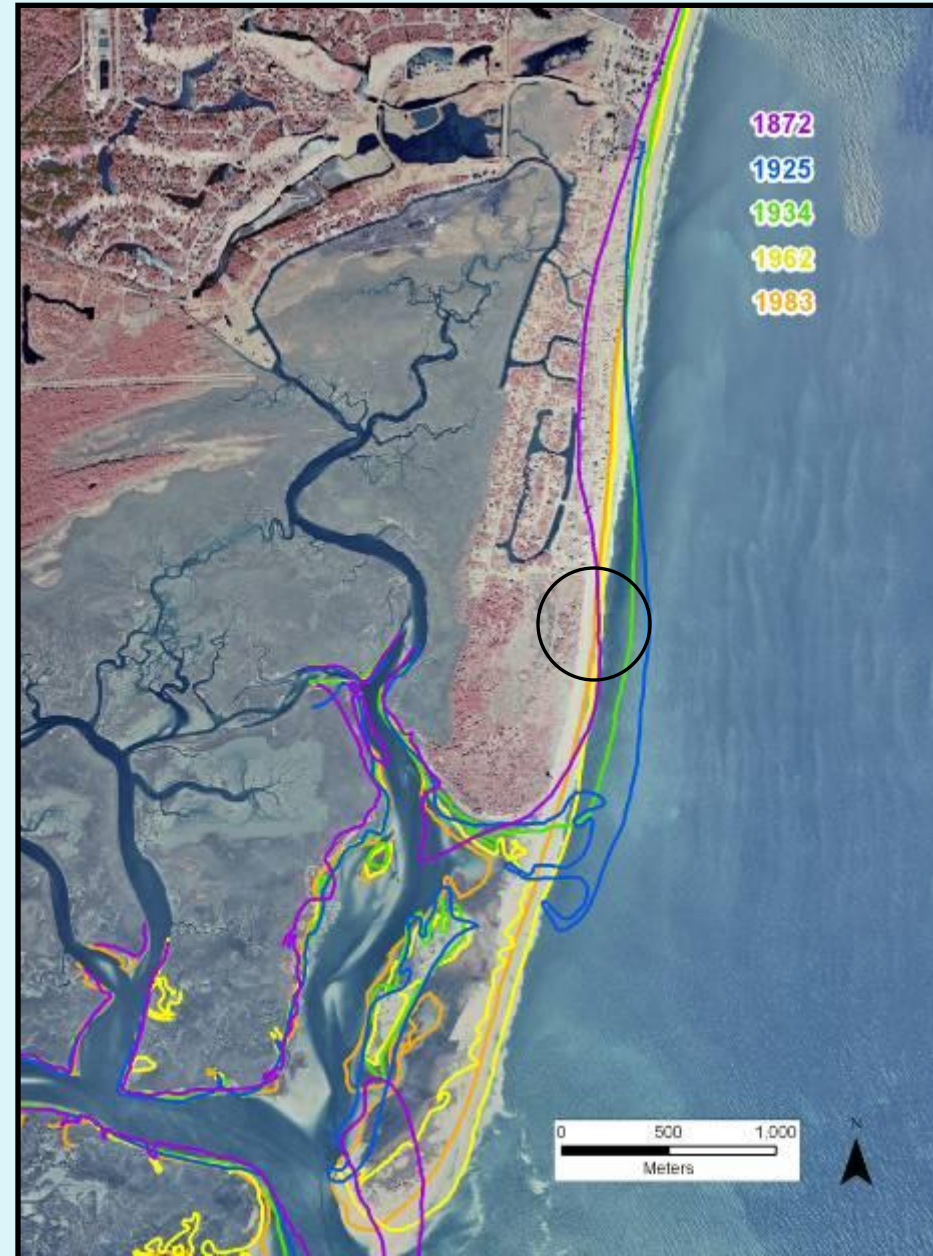
Complete Active Beach System Profiles

*Sled
Single Beam w/ RTK DGPS ATV*

*Statewide Dataset Establishes
Jurisdictional
Baseline in SC.*

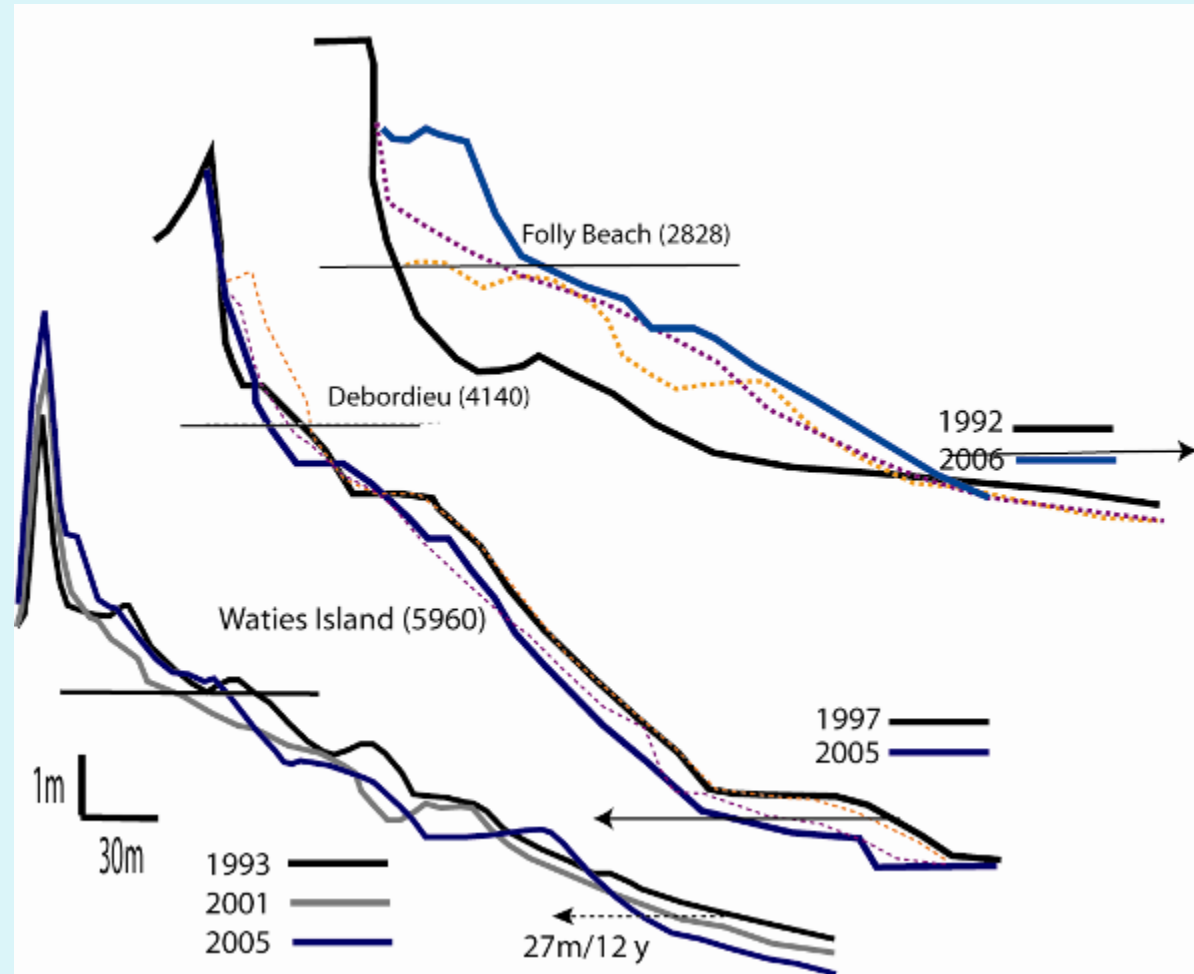
Defining Coastal Behavior

Historical Shoreline Change

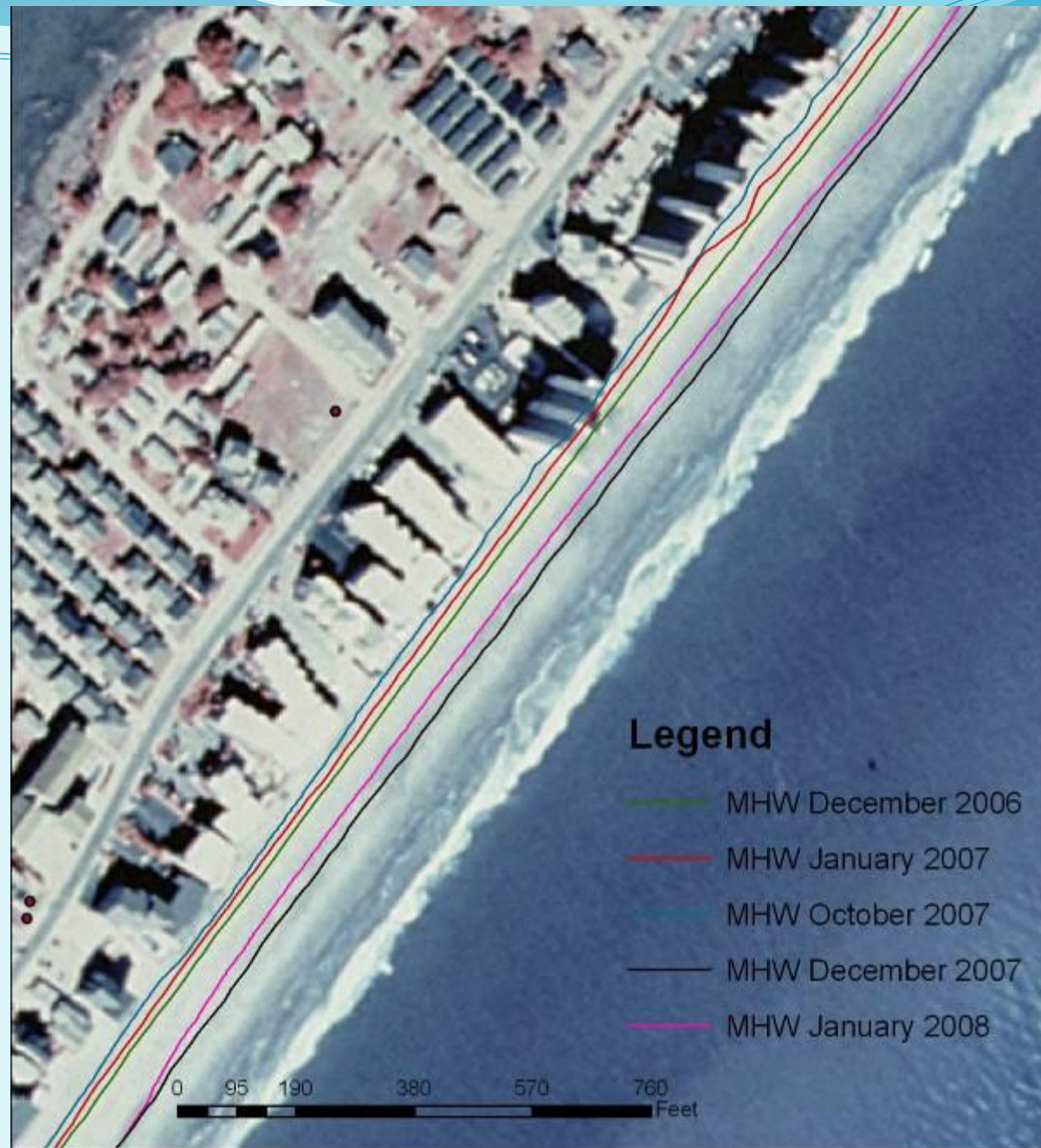


BERM

Shoreline Erosion



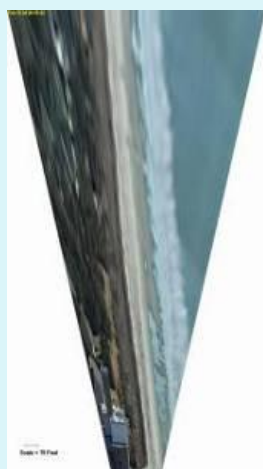
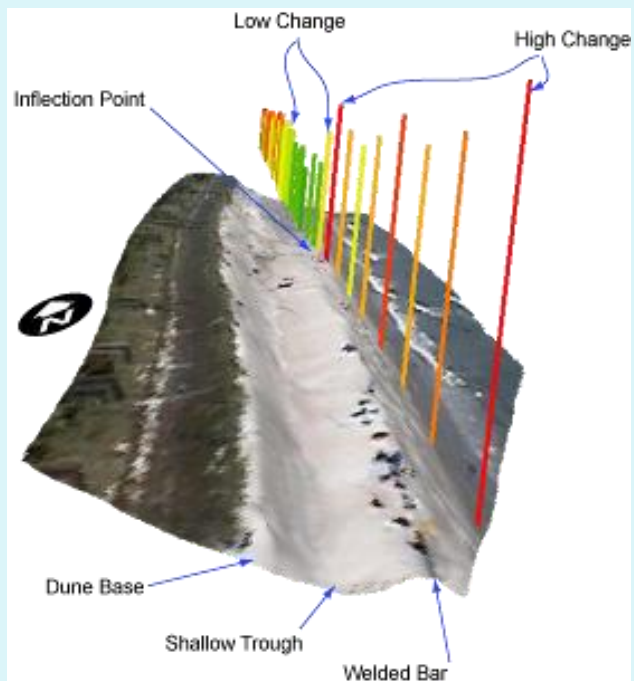
“SWASH”



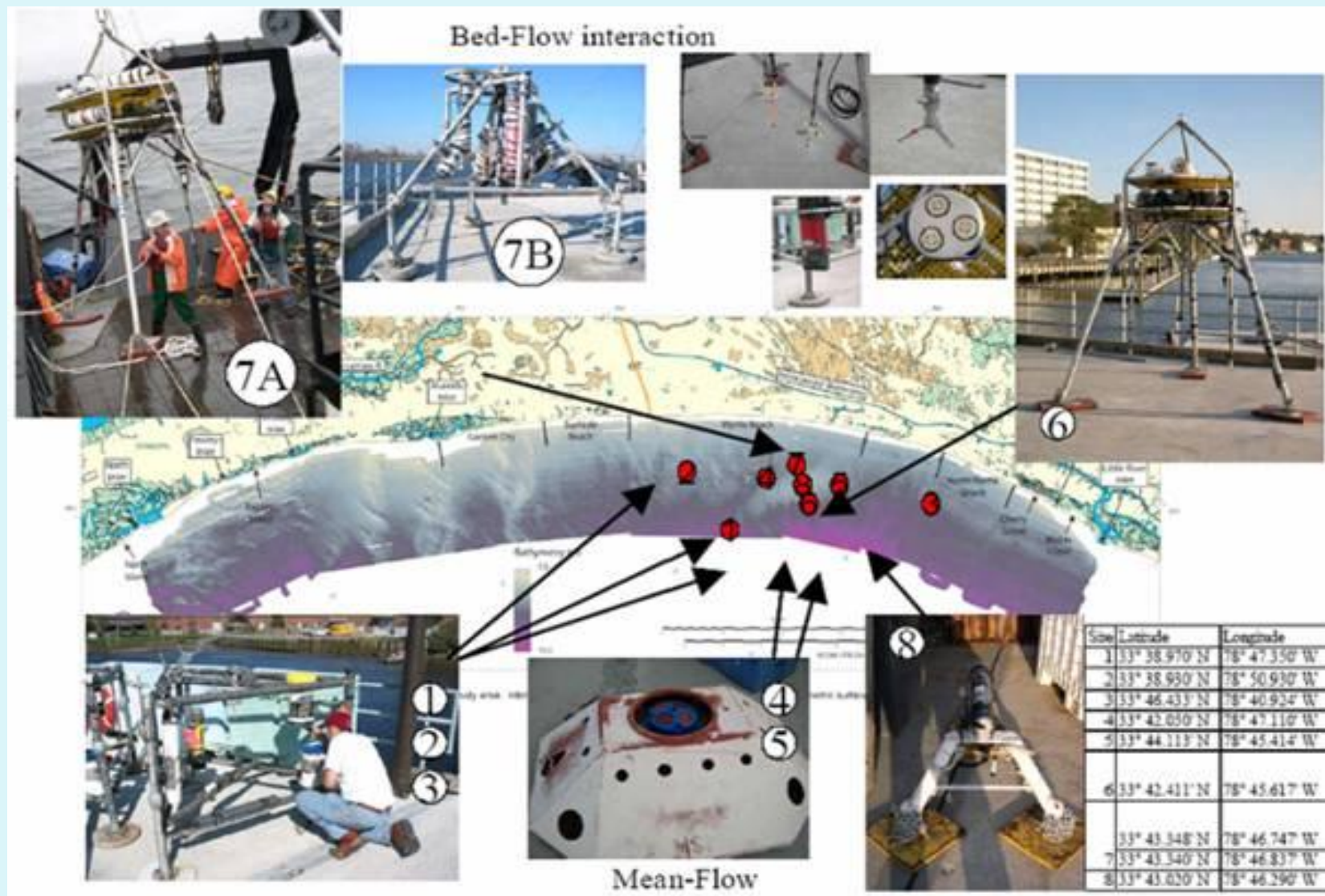
Aerial and Truck/Boat Mounted LIDAR

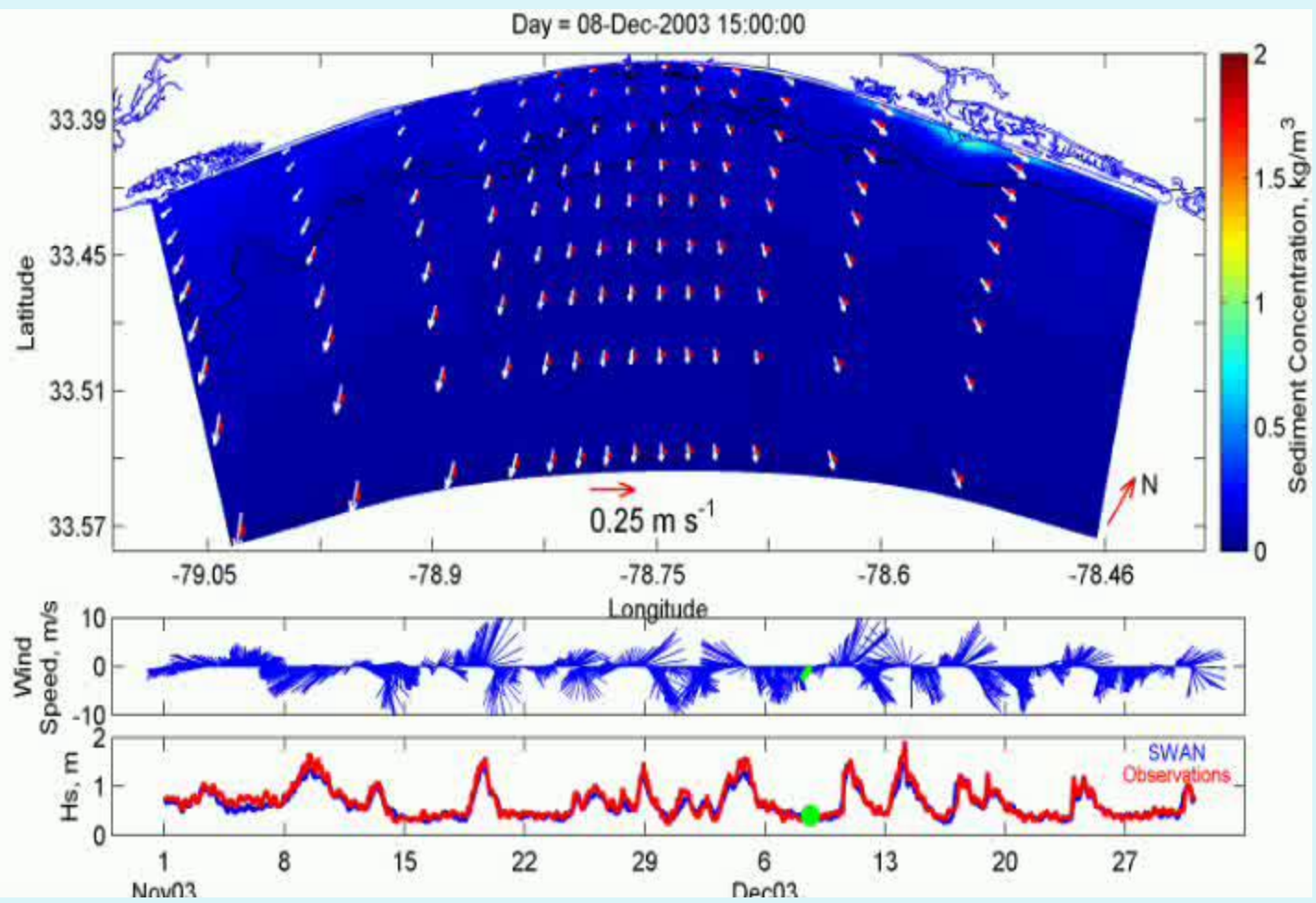


BEACH CAM

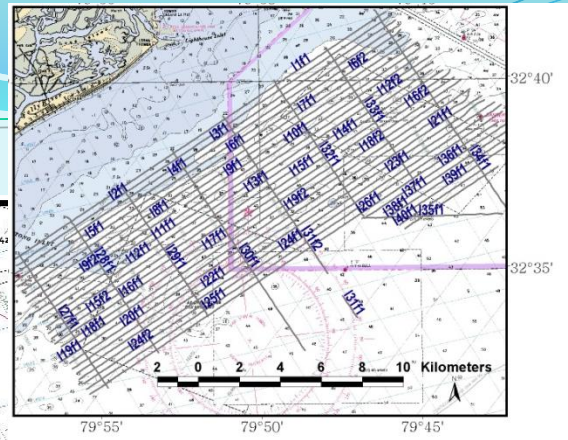
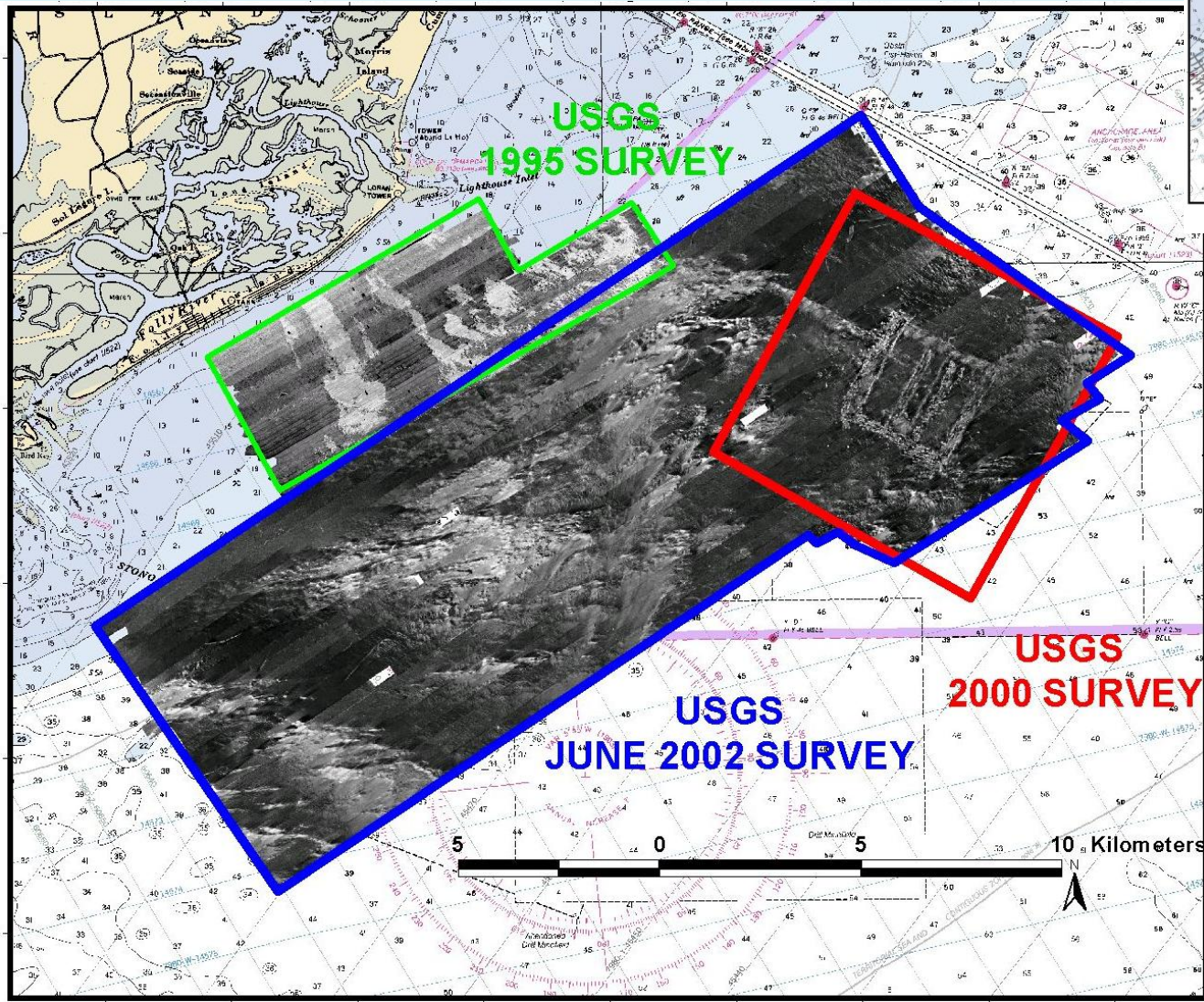


Physical Processes



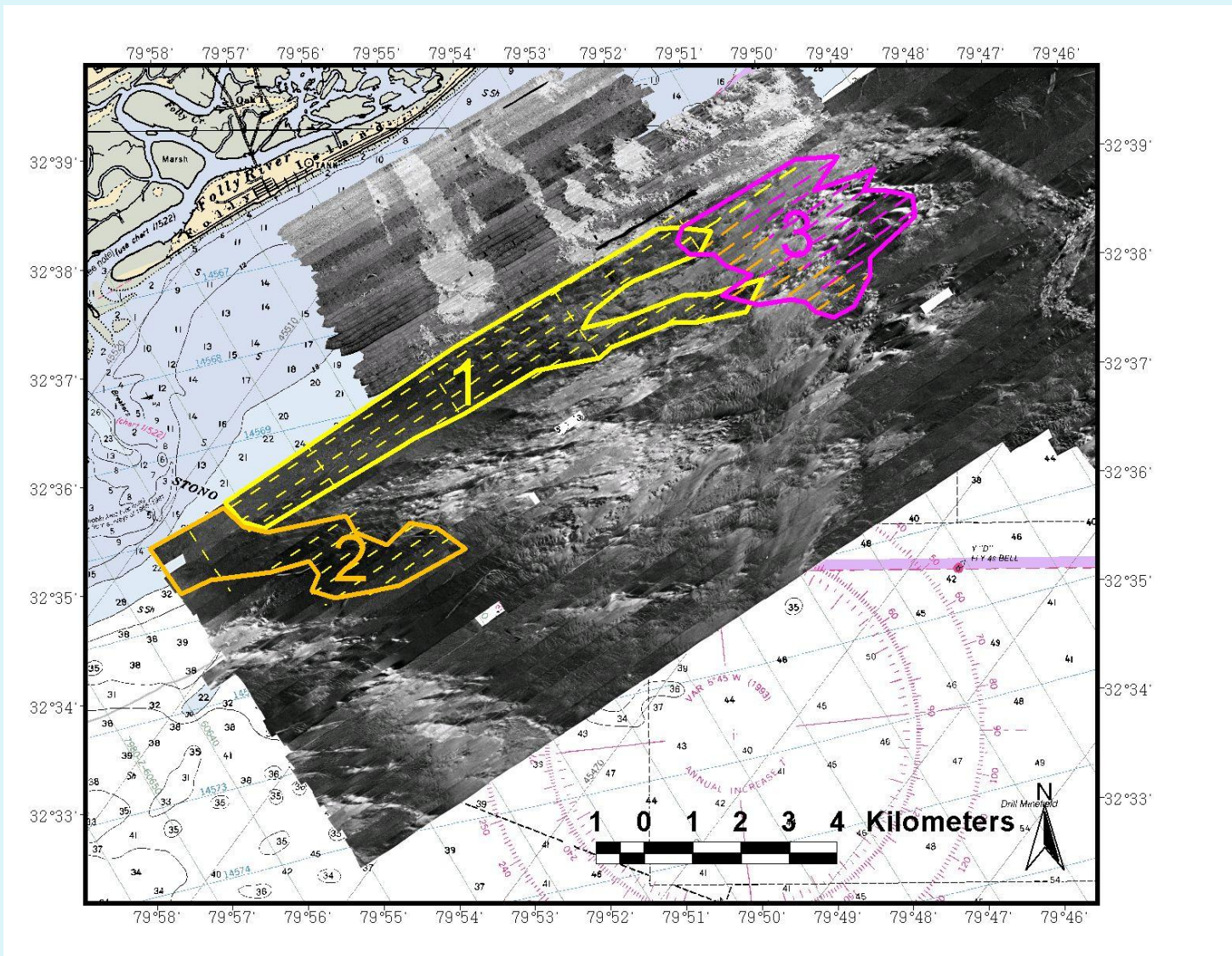


Charleston Area Add Ons



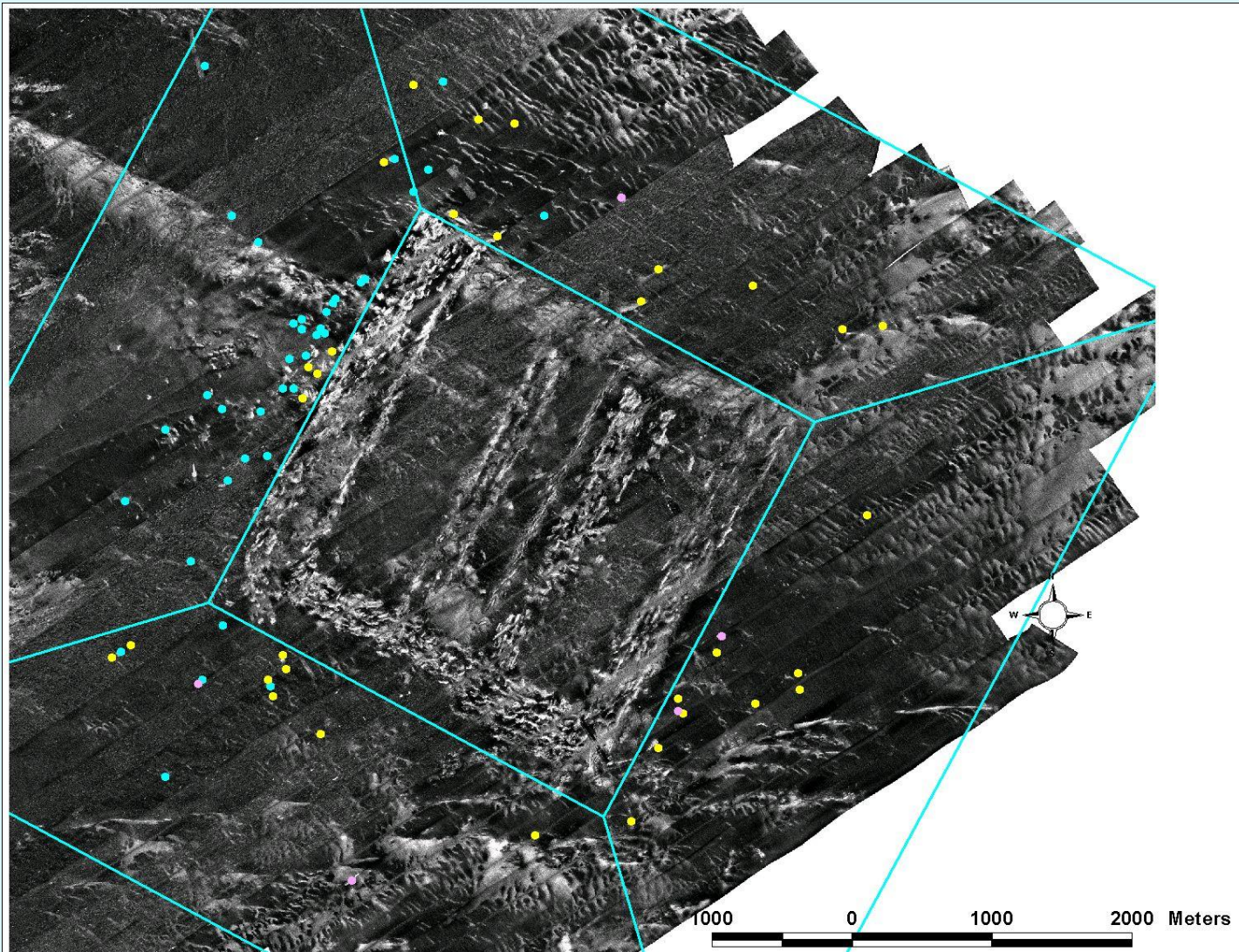
Folly Beach Sand Resources Study

From Gayes, Schwab and Denny, 2003



ODMDS

Habitat Studies

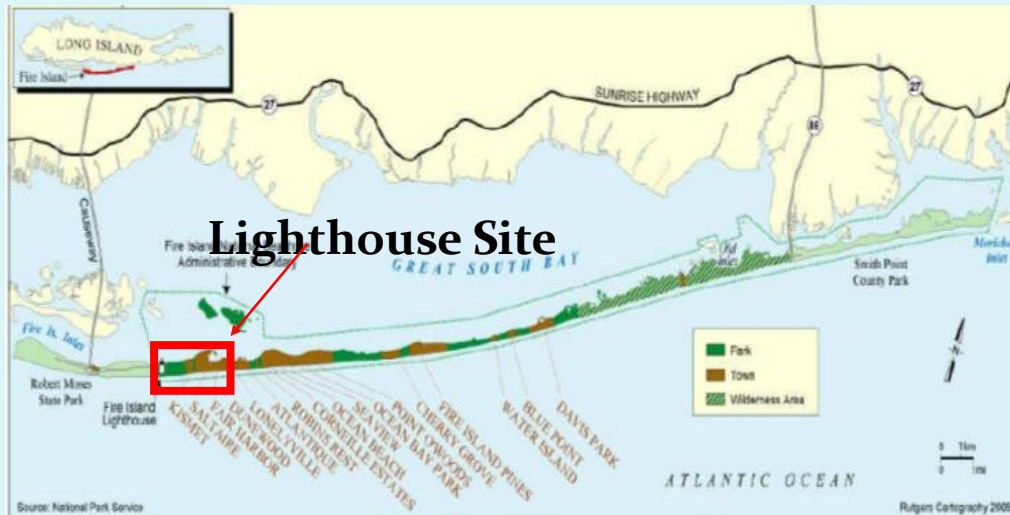


Mis-Dumps identified acoustically at Charleston ODMDS

From Gayes and Ojeda, 2000 and 2001

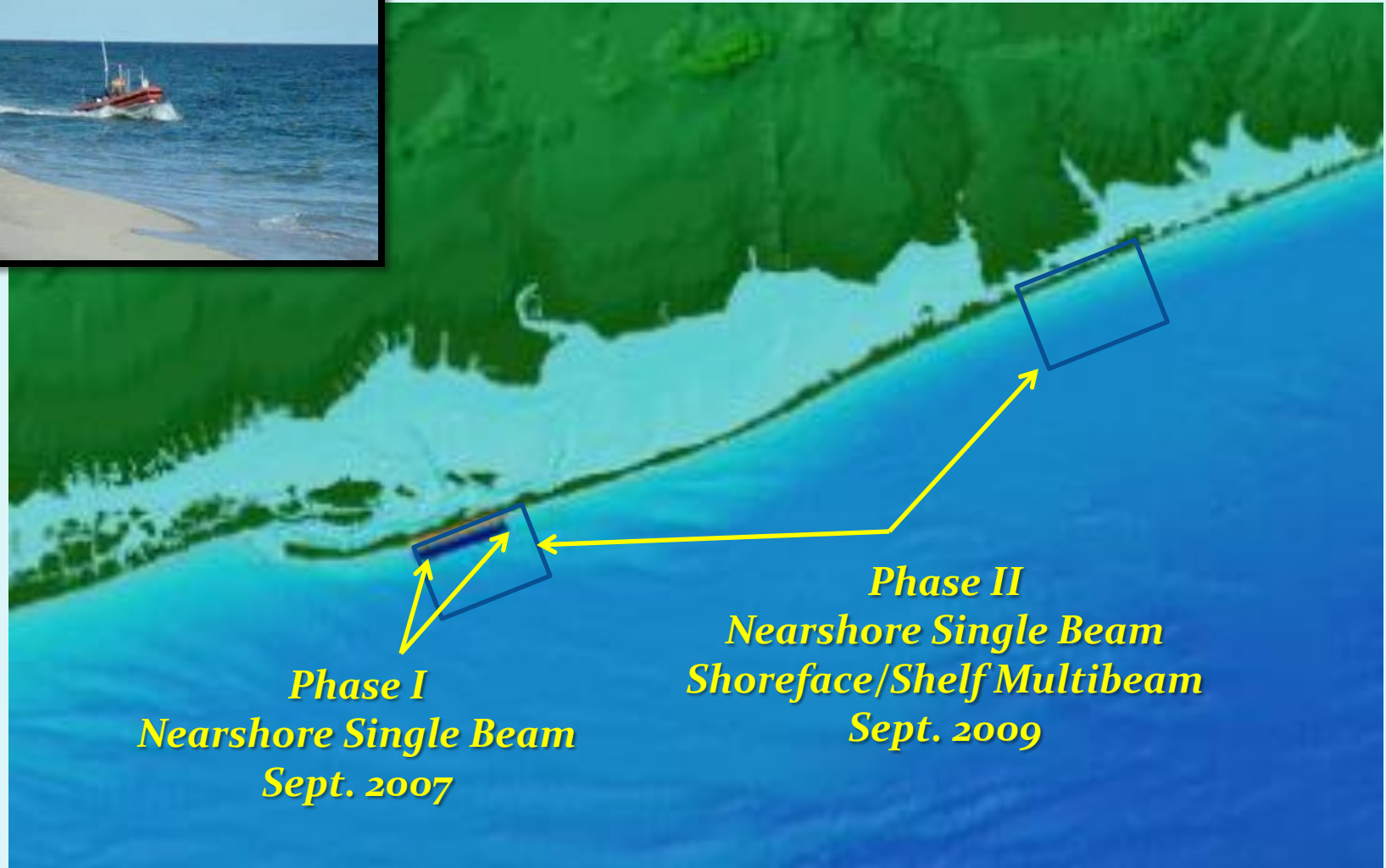


*Fire Island (FINS) Shelf Sand
Ridges Connections to the Beach?*

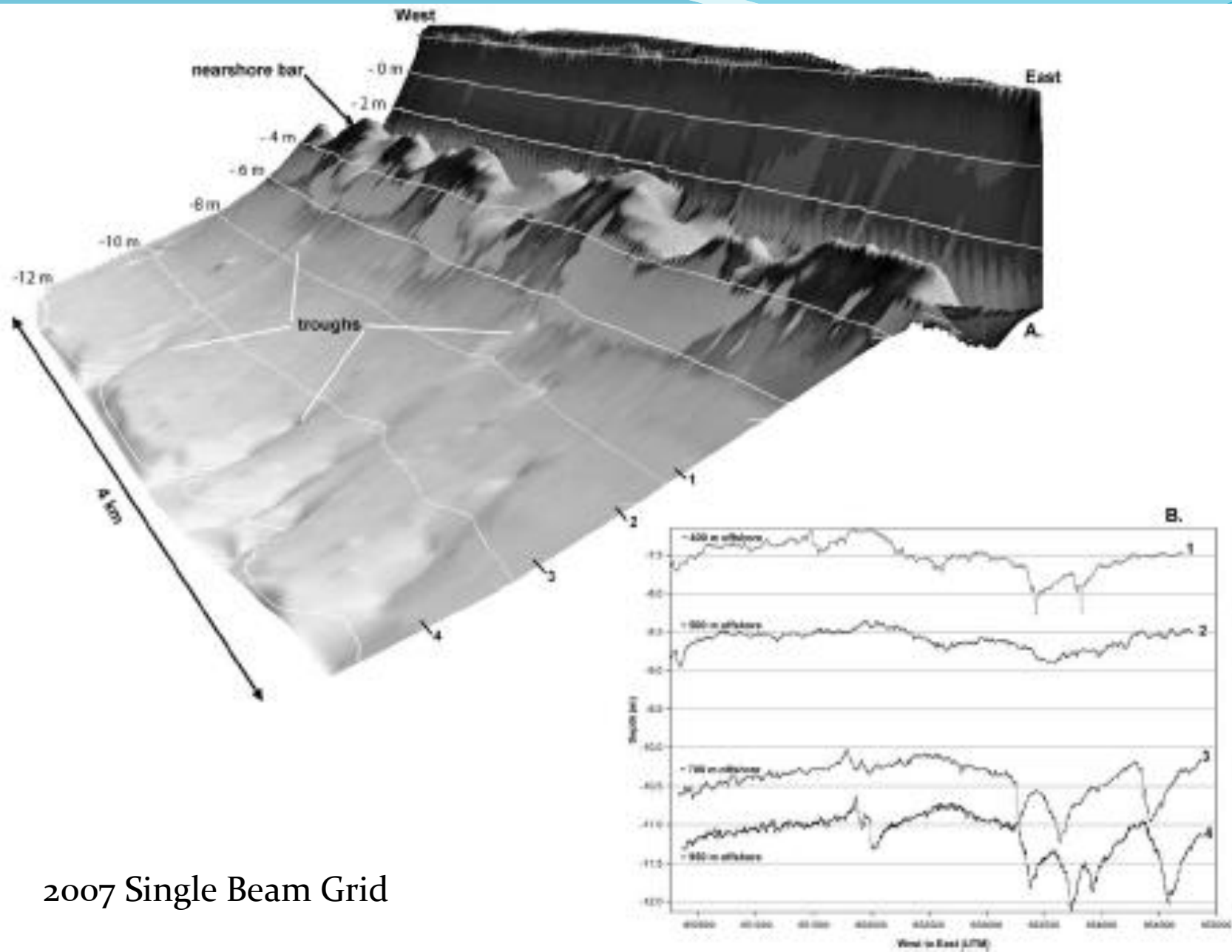


2007 Pilot Project

- *Detailed bathymetry 0-10 m for small stretch of Fire Island Shoreface*
- *In context of broader regional efforts (USGS onshore and offshore)*
- *Is there an expression of oblique sand ridges across the shoreface???*

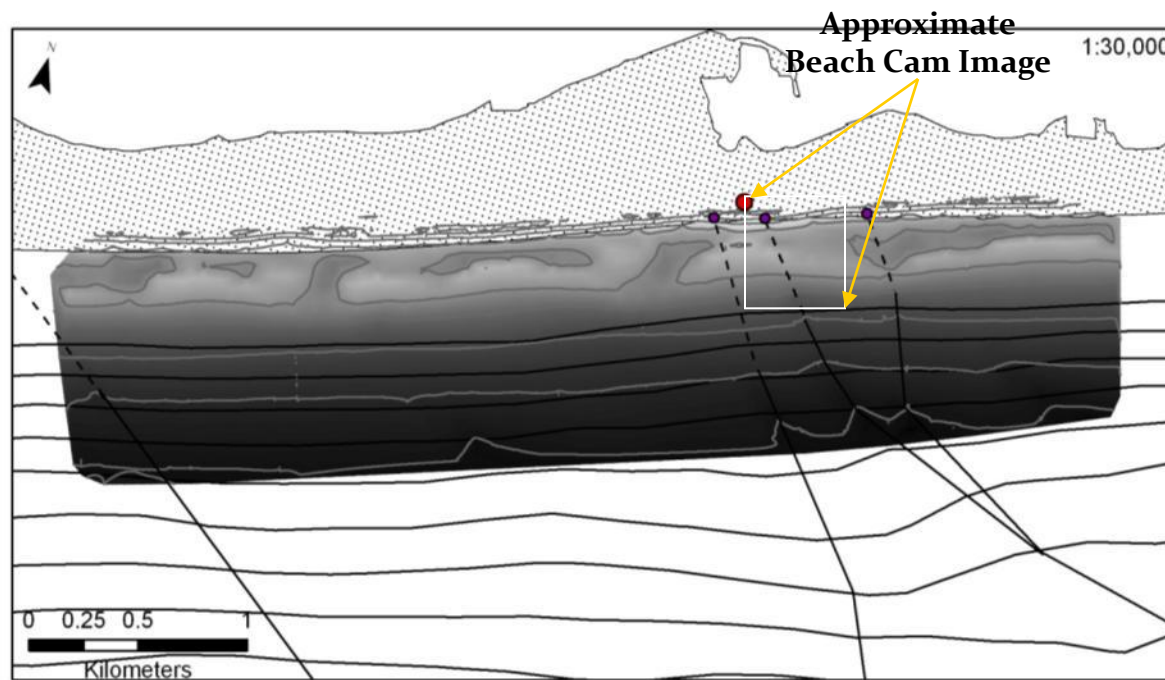
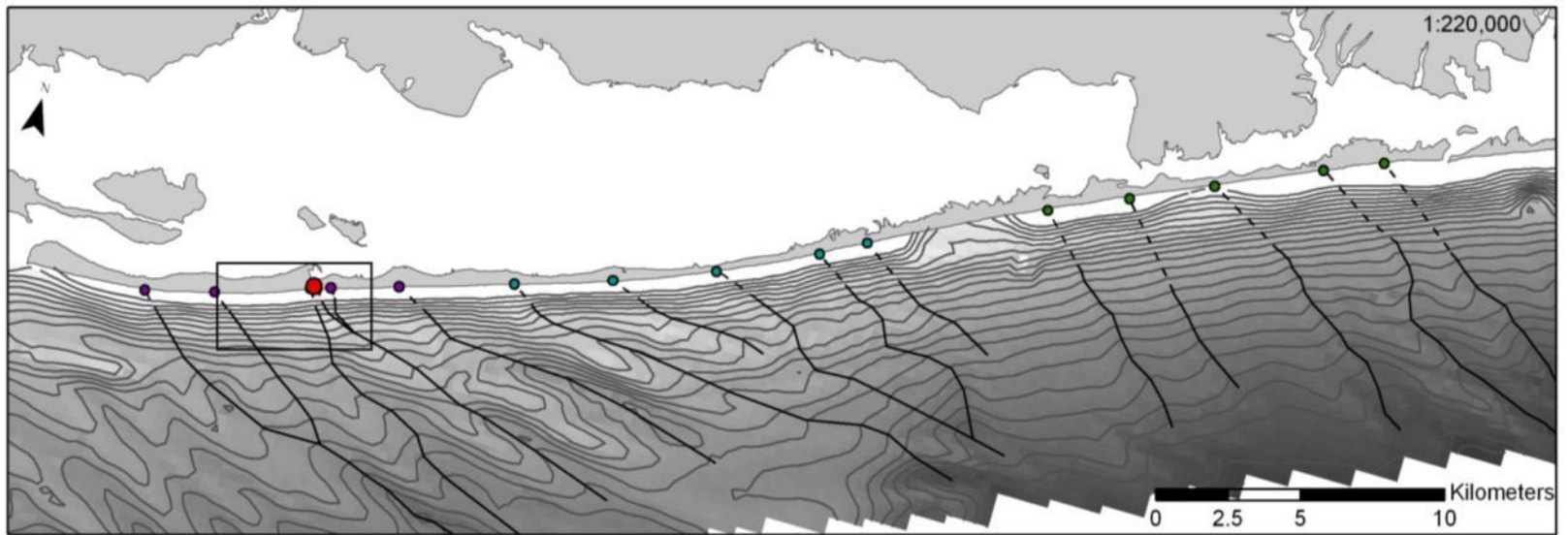


1. Morphologic relationship between offshore ridges, nearshore bar and Shoreline Behavior
2. Shelf – Beach Transition – Ridge vs. Non-Ridge Area



2007 Single Beam Grid

AFTER – Hapke et al., in press, A review of Sediment Budget Imbalances along Fire Island, New York: Can Nearshore Geologic Framework and Patterns of Shoreline Change Explain the Deficit?, Journal of Coastal Research





Beach Cam

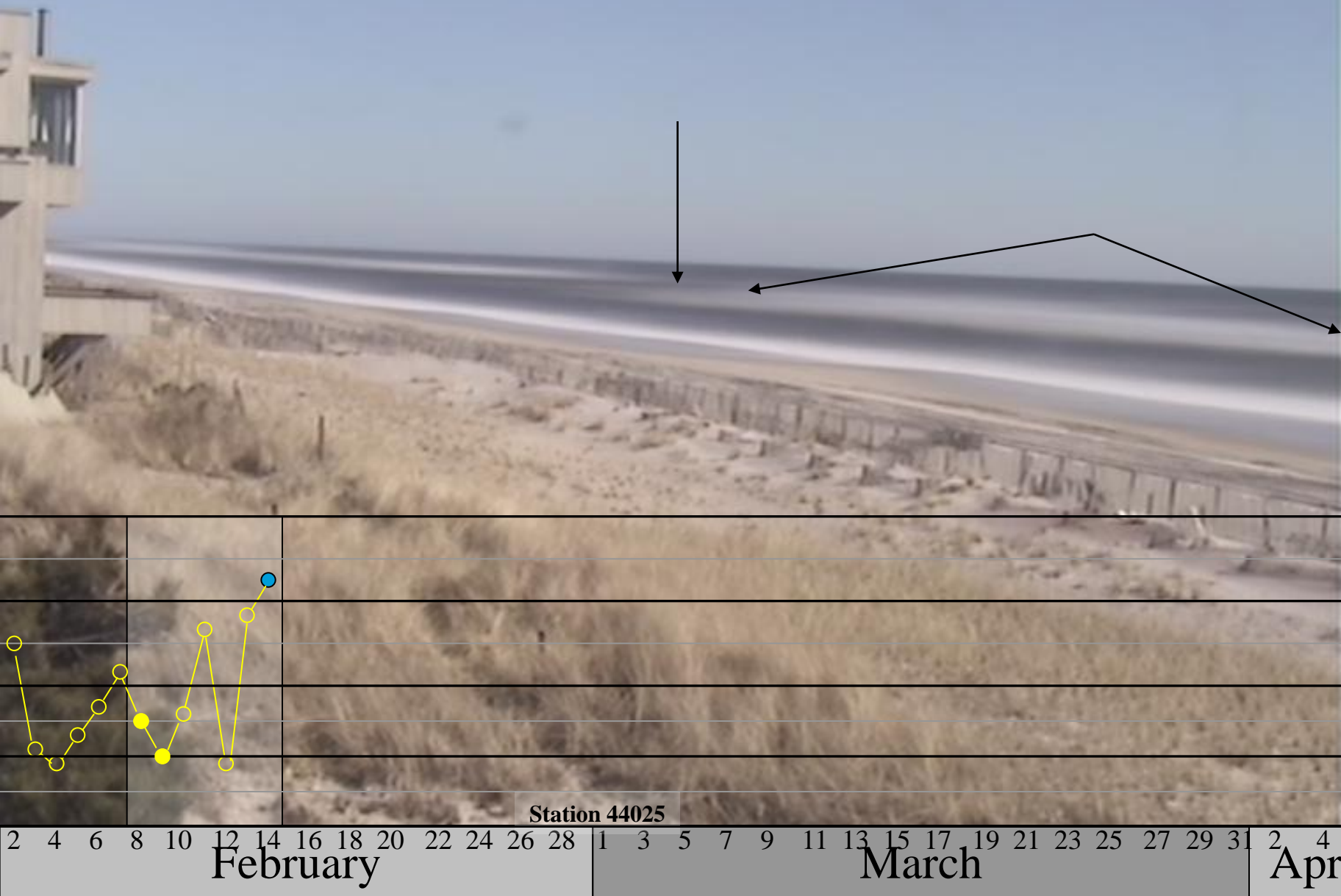
Jan-April 2008

Feb 08 08 14:03:02 876 images averaged over 5.minutes, 2.92 frames/sec.

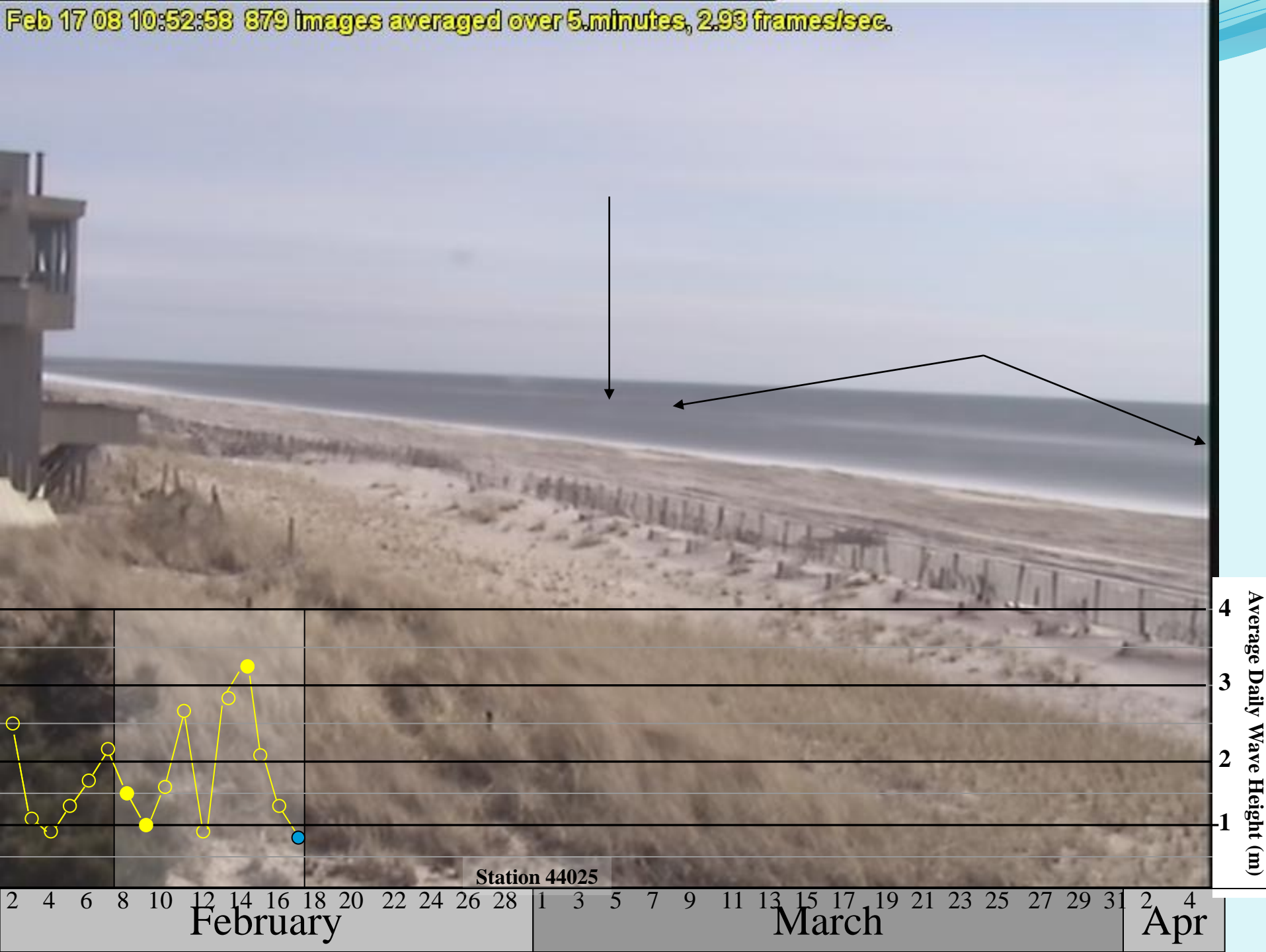


Feb 14 08 13:03:20 883 images averaged over 5.minutes, 2.94 frames/sec.

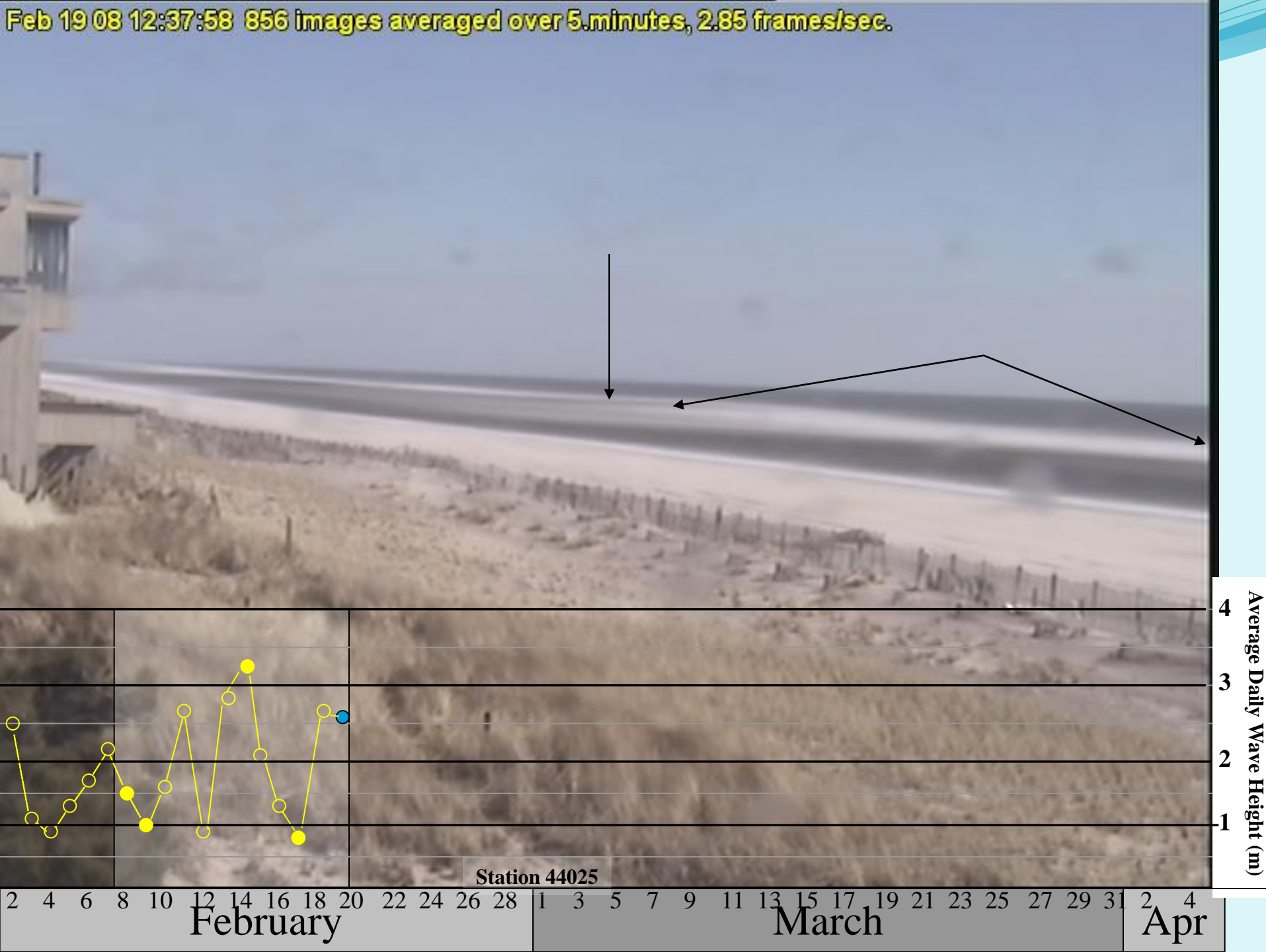
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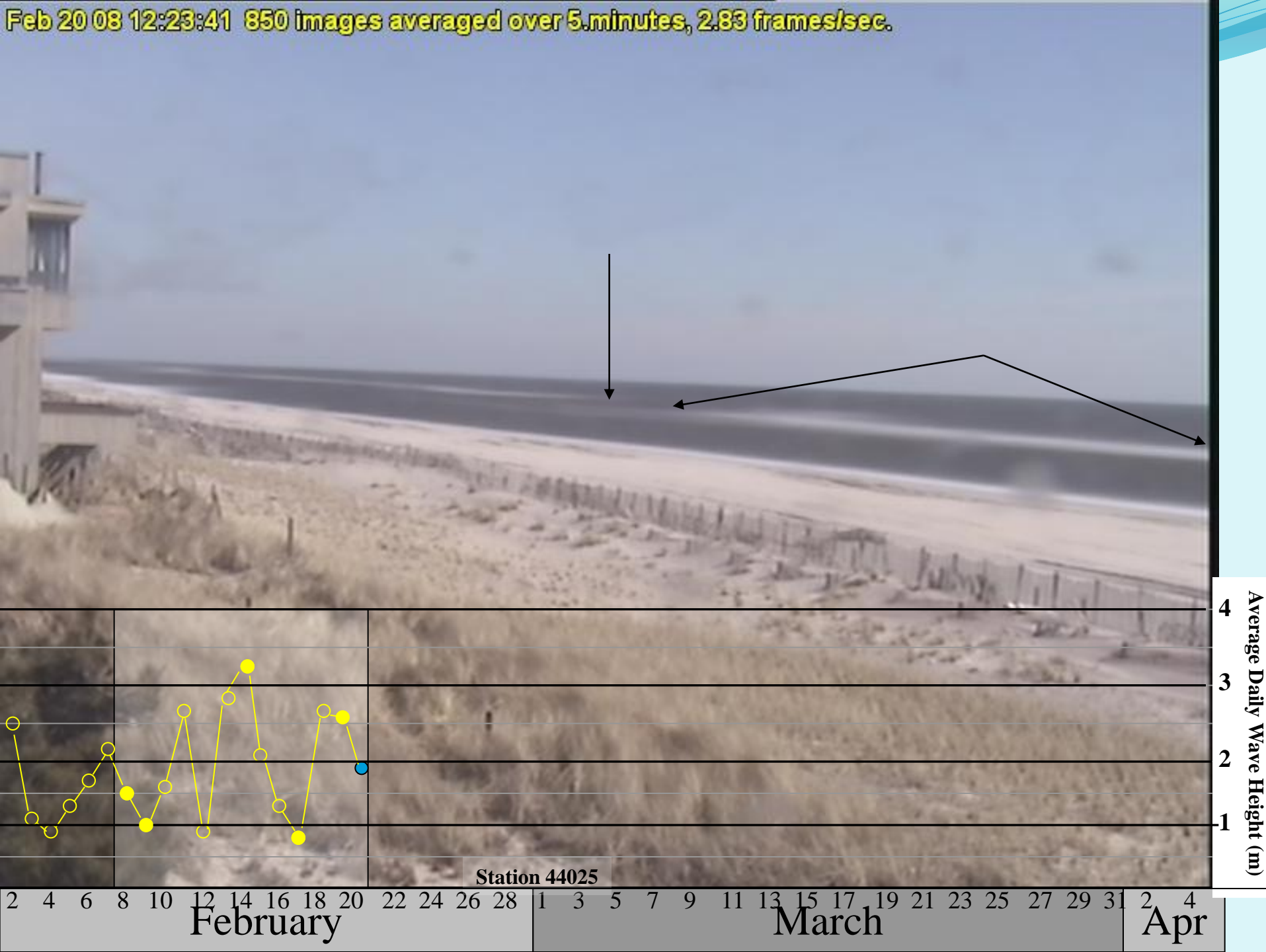
Feb 17 08 10:52:58 879 images averaged over 5.minutes, 2.93 frames/sec.



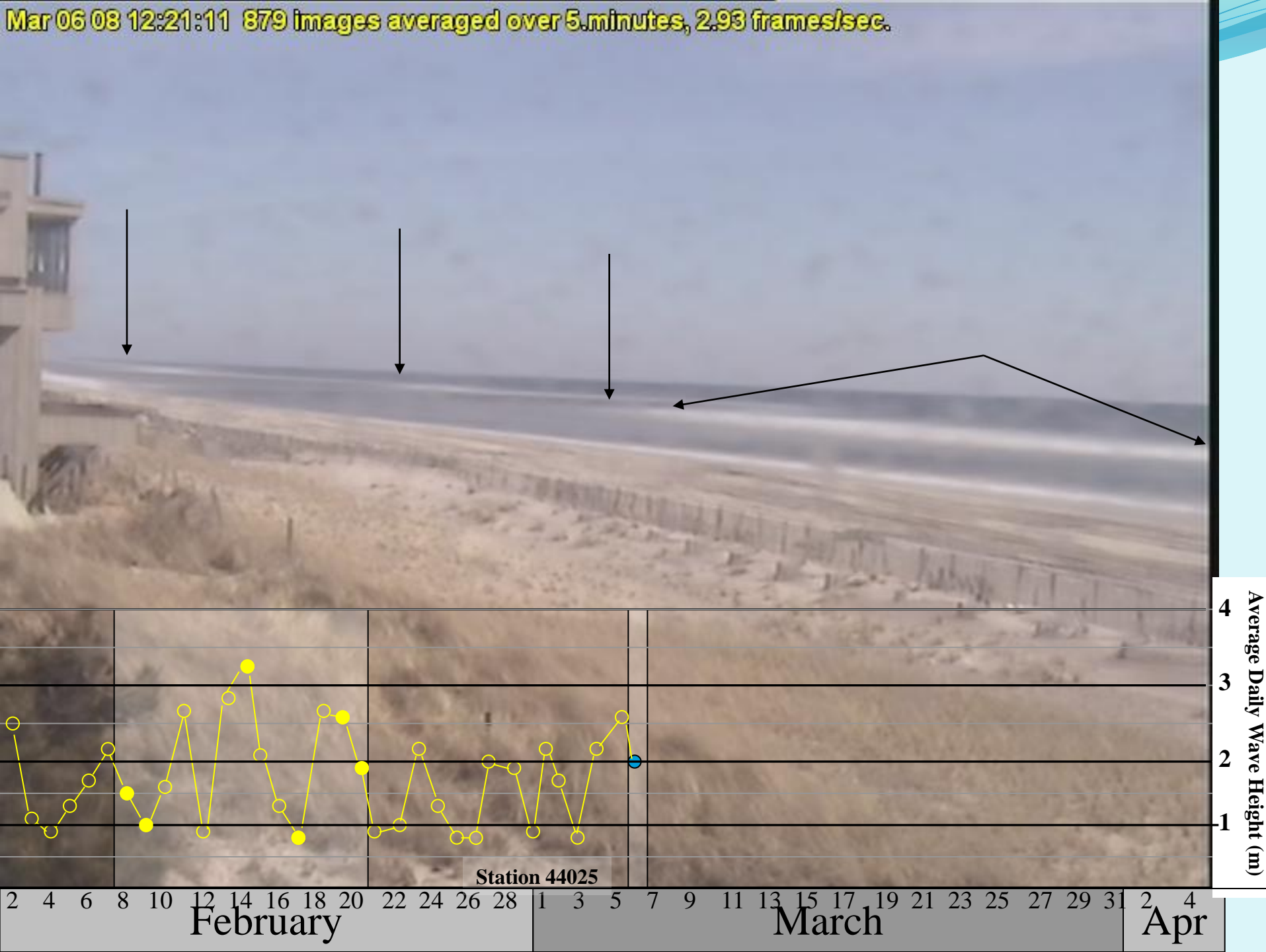
Feb 19 08 12:37:58 856 images averaged over 5.minutes, 2.85 frames/sec.



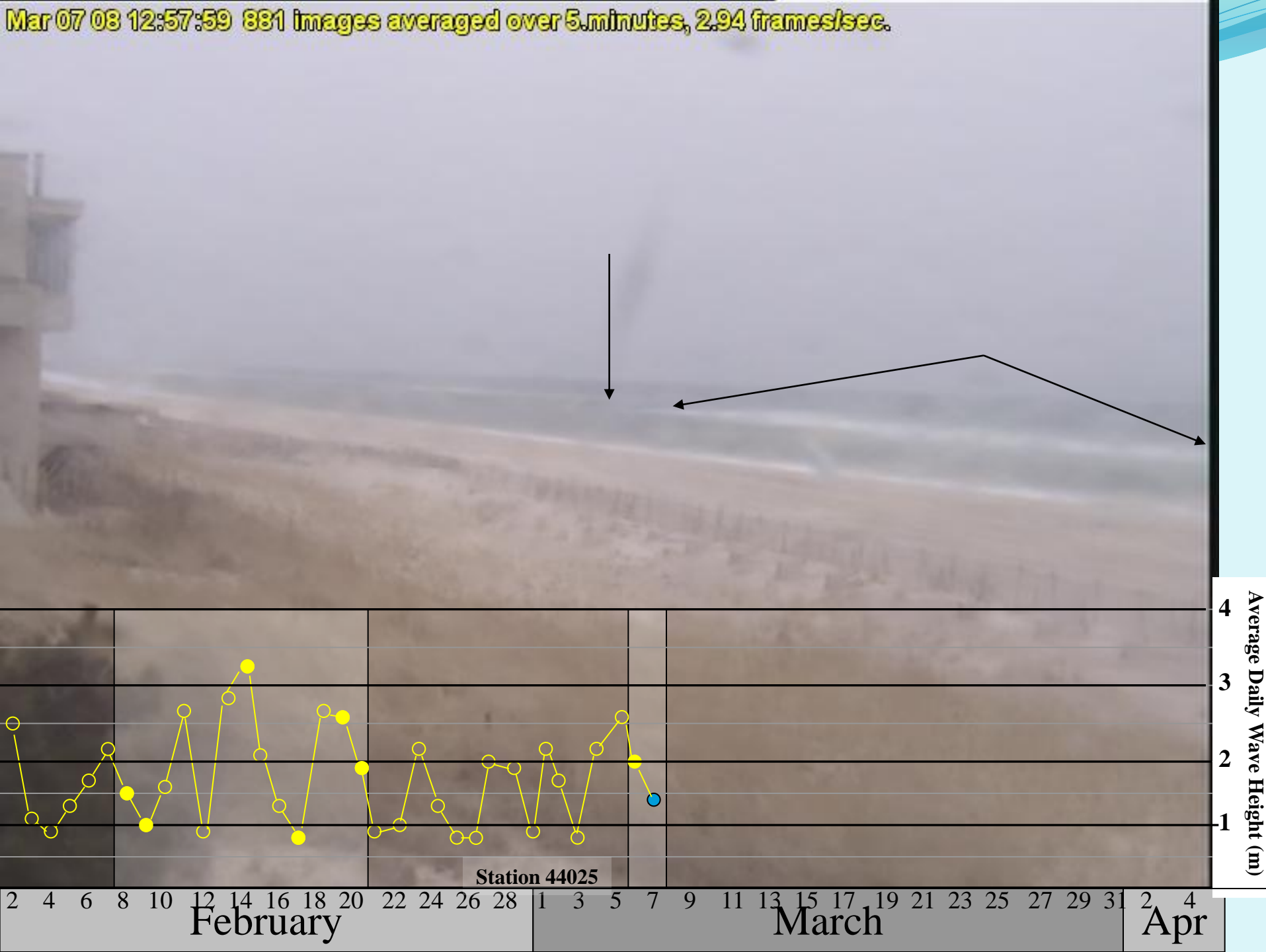
Feb 20 08 12:23:41 850 images averaged over 5.minutes, 2.83 frames/sec.



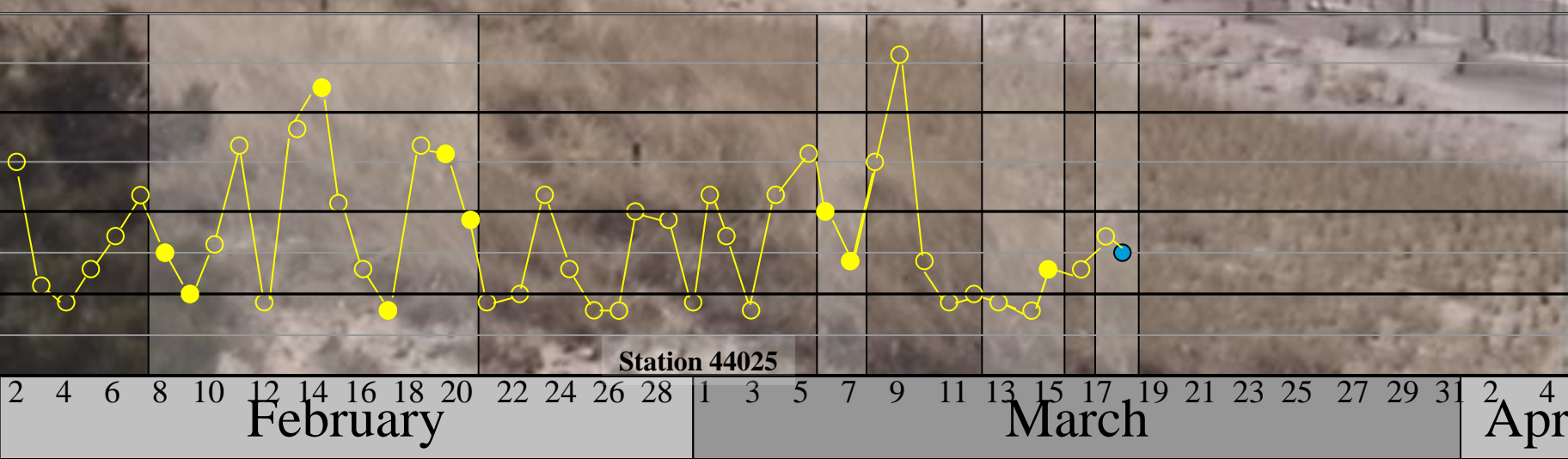
Mar 06 08 12:21:11 879 images averaged over 5.minutes, 2.93 frames/sec.



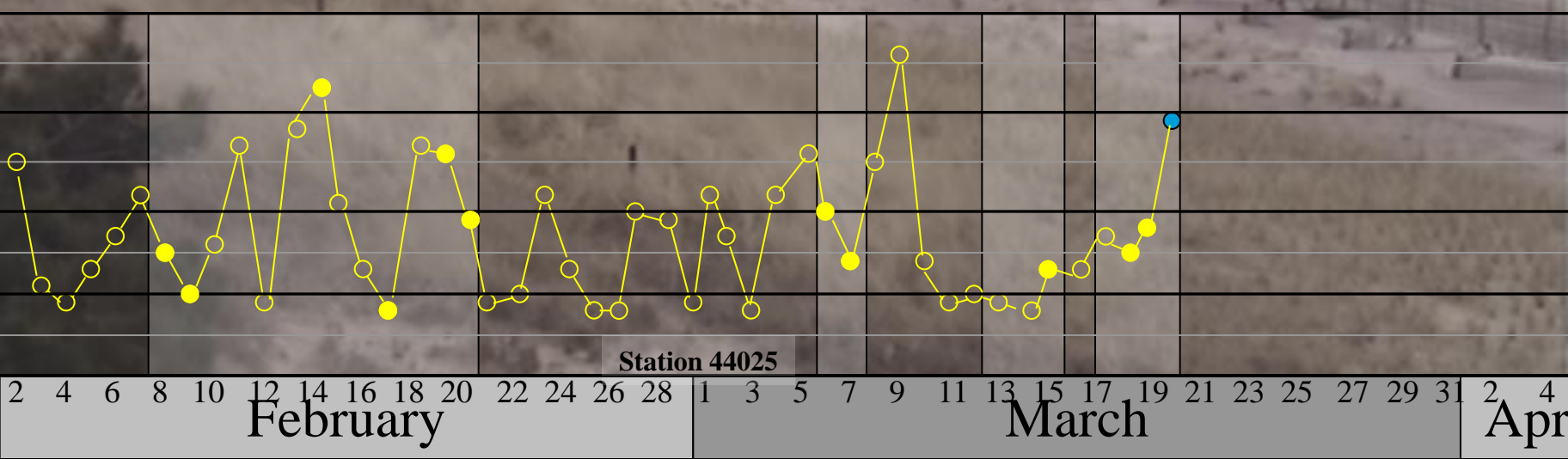
Mar 07 08 12:57:59 881 images averaged over 5.minutes, 2.94 frames/sec.



Mar 18 08 12:07:15 878 Images averaged over 5.minutes, 2.93 frames/sec.

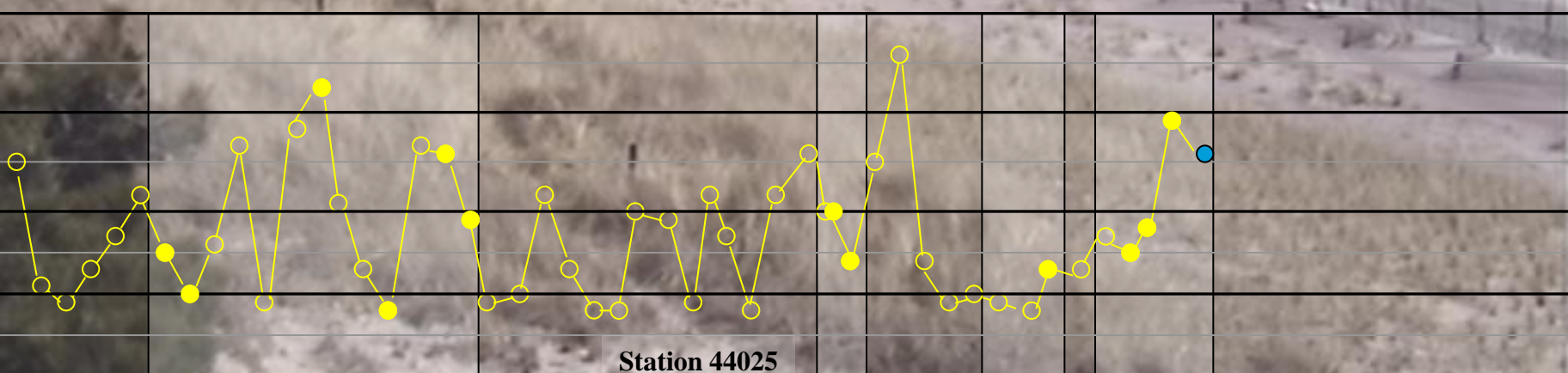


Mar 20 08 12:17:15 879 Images averaged over 5.minutes, 2.93 frames/sec.



Average Daily Wave Height (m)

Mar 21 08 13:52:56 879 images averaged over 5.minutes, 2.93 frames/sec.



Station 44025

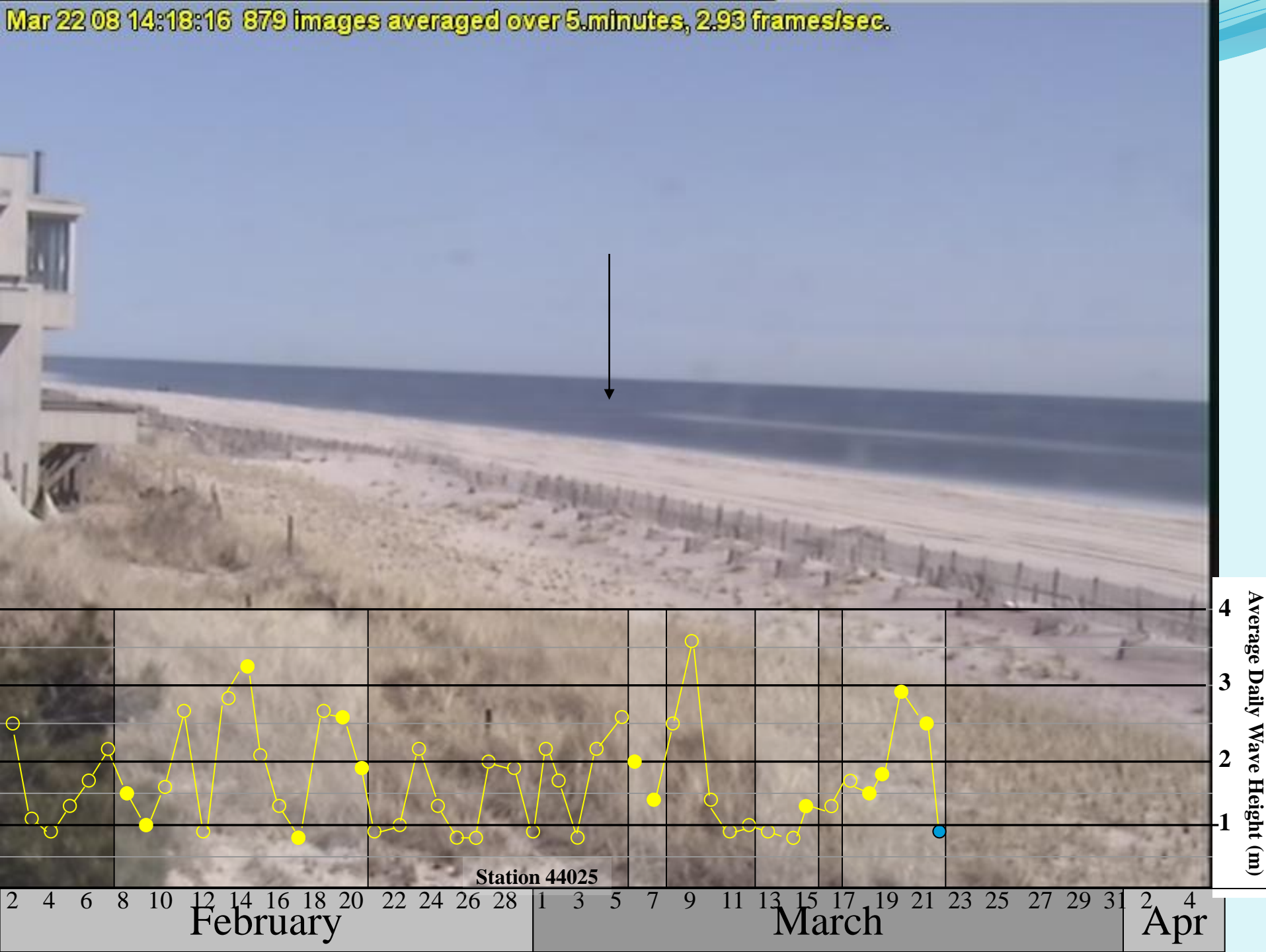
Average Daily Wave Height (m)

February

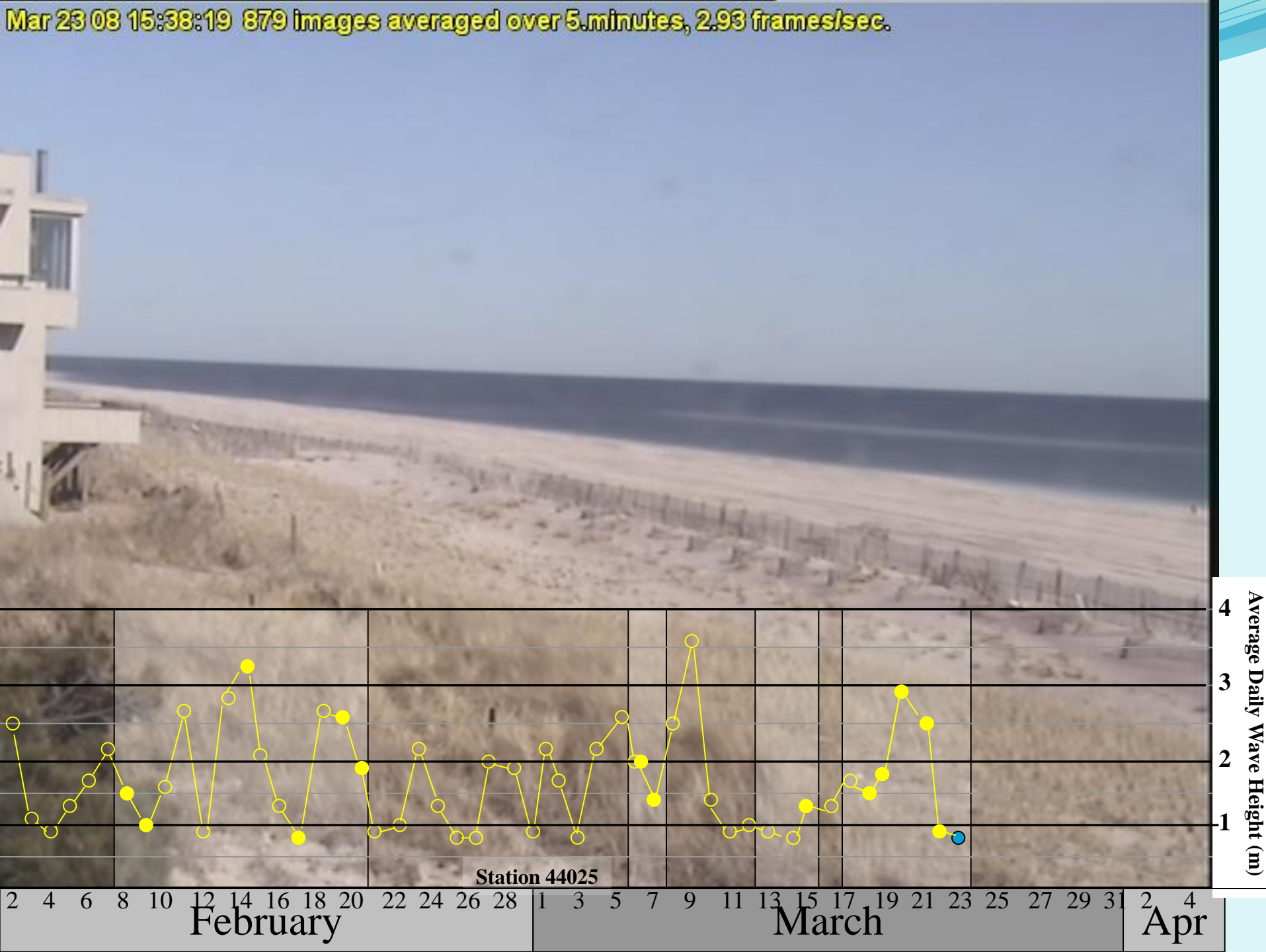
March

Apr

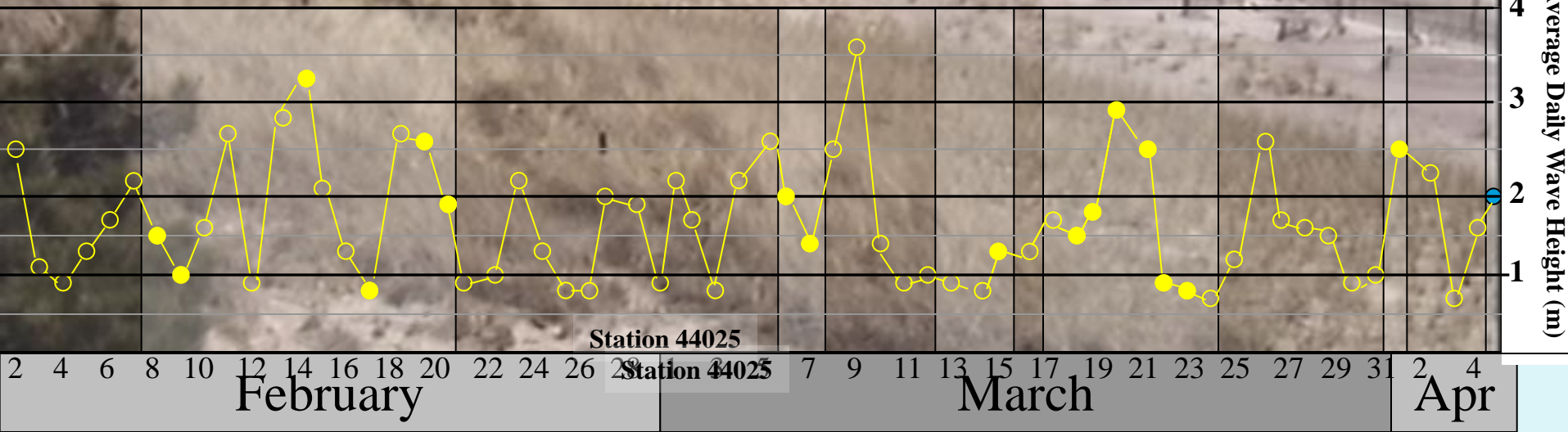
Mar 22 08 14:18:16 879 images averaged over 5.minutes, 2.93 frames/sec.

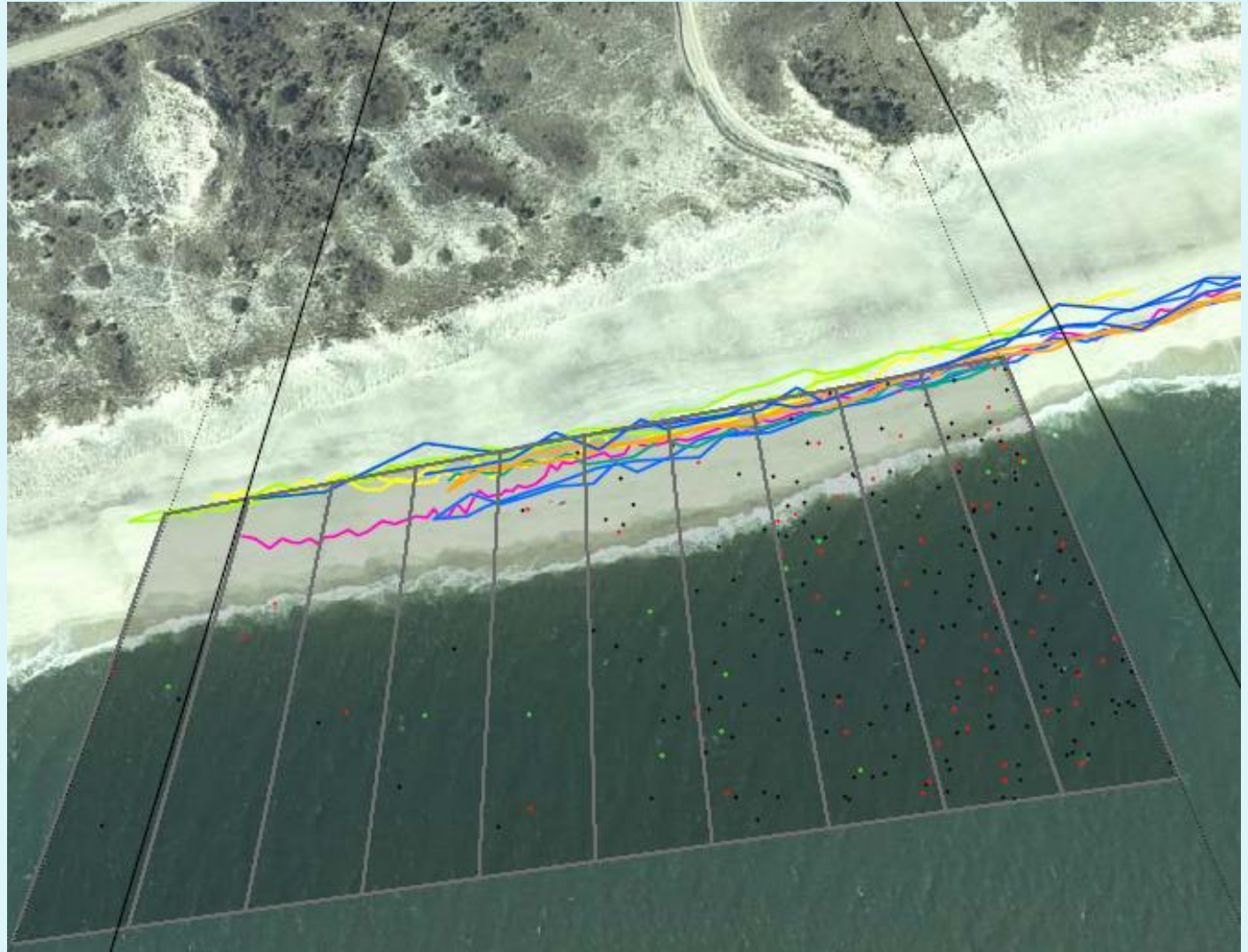


Mar 23 08 15:38:19 879 images averaged over 5.minutes, 2.93 frames/sec.

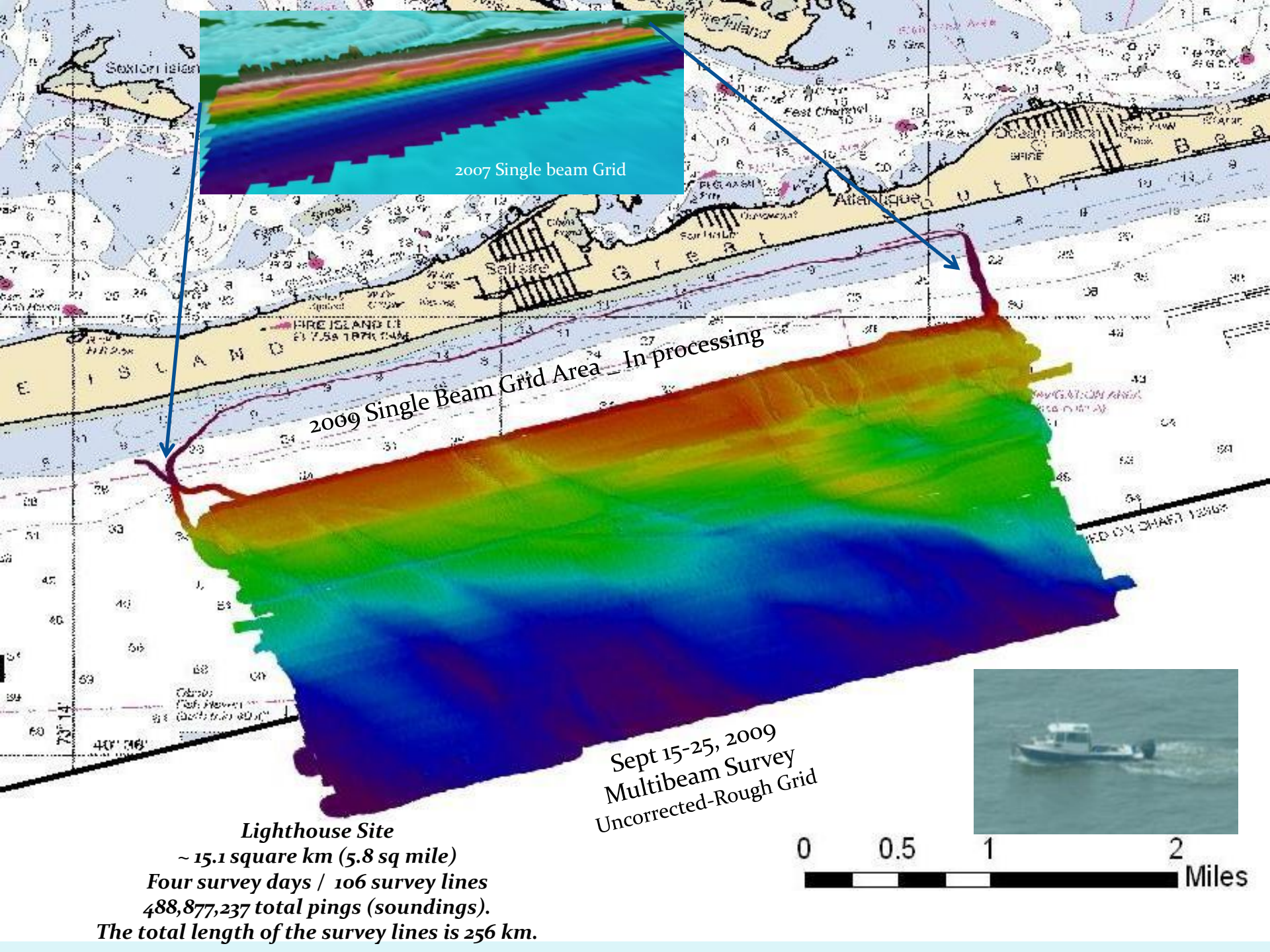


Apr 05 08 13:09:49 879 images averaged over 5 minutes, 2.93 frames/sec.





John LaBold, Etienne Larangot, and Allison Truhlar- Stony Brook RUE Project



2007 Single beam Grid

2009 Single Beam Grid Area - In processing

Sept 15-25, 2009
Multibeam Survey
Uncorrected-Rough Grid

Lighthouse Site

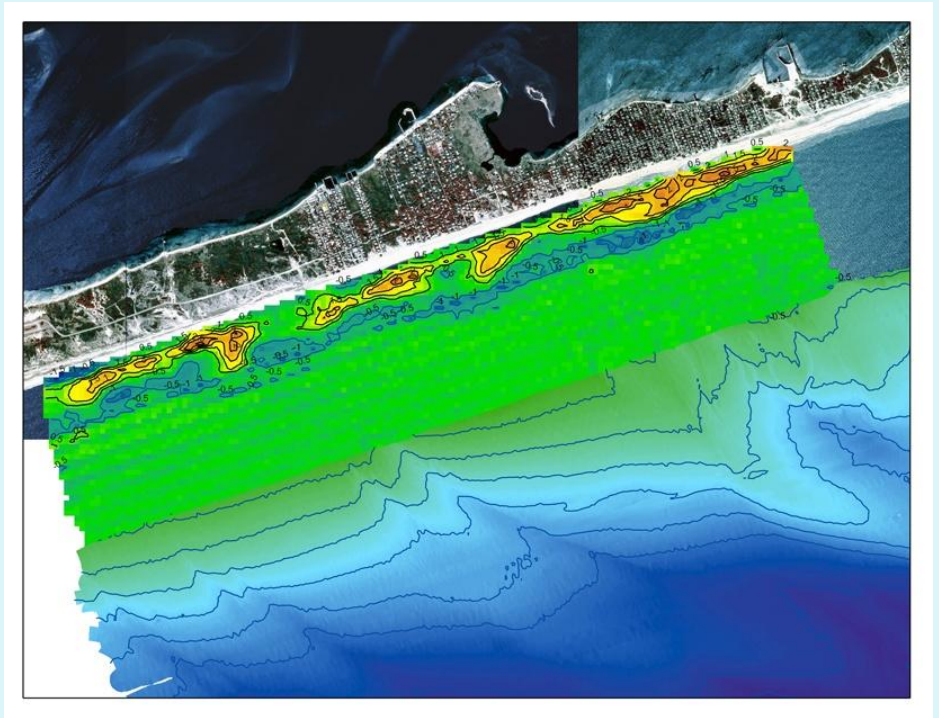
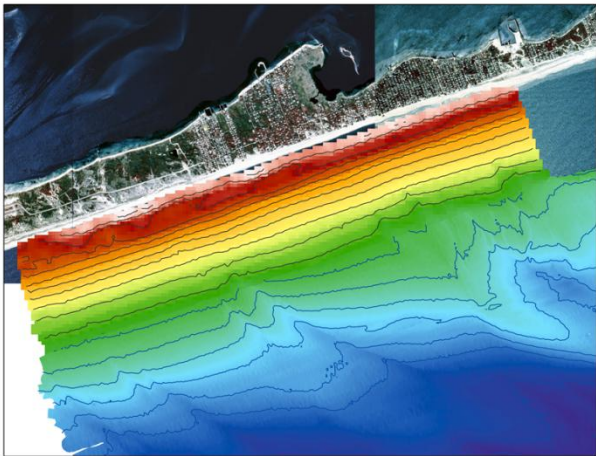
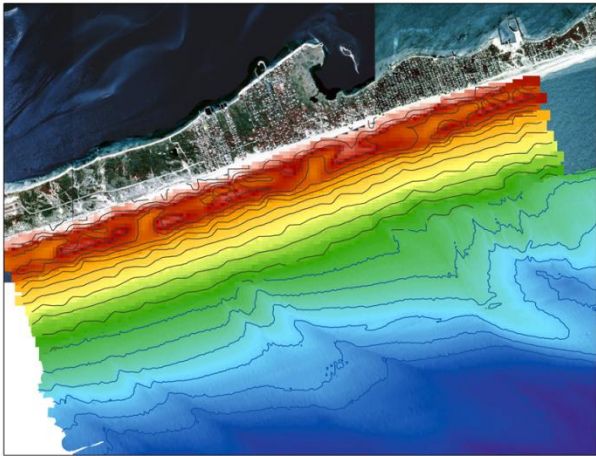
~ 15.1 square km (5.8 sq mile)

Four survey days / 106 survey lines

488,877,237 total pings (soundings).

The total length of the survey lines is 256 km.

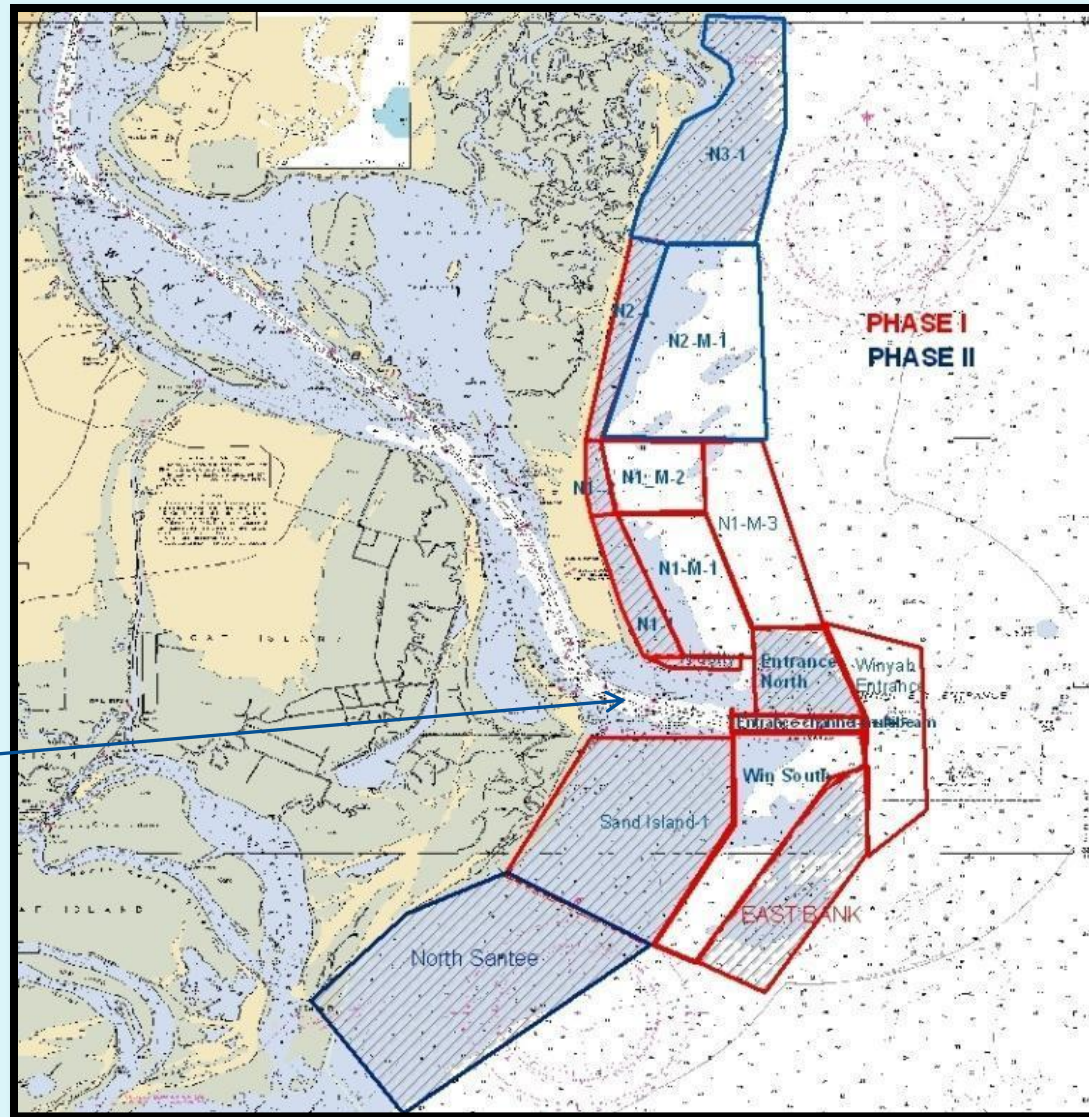
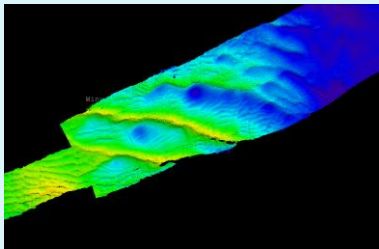
0 0.5 1 2 Miles



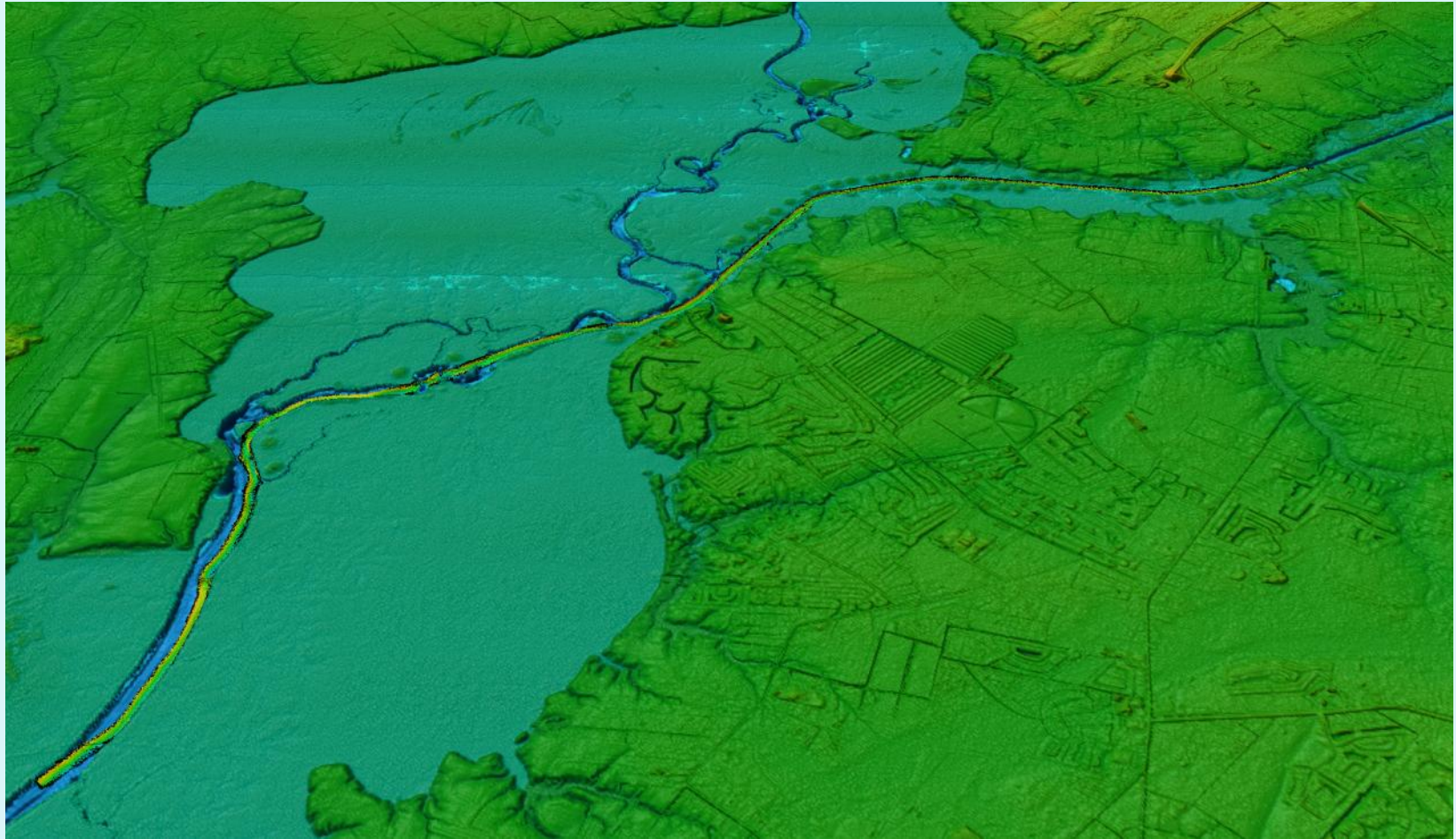
US Army Corps of Engineers-Regional Sediment Management (RSM)

Detailed Comprehensive Baseline – WINYAH BAY ENTRANCE

Navigation Channel and AIWW

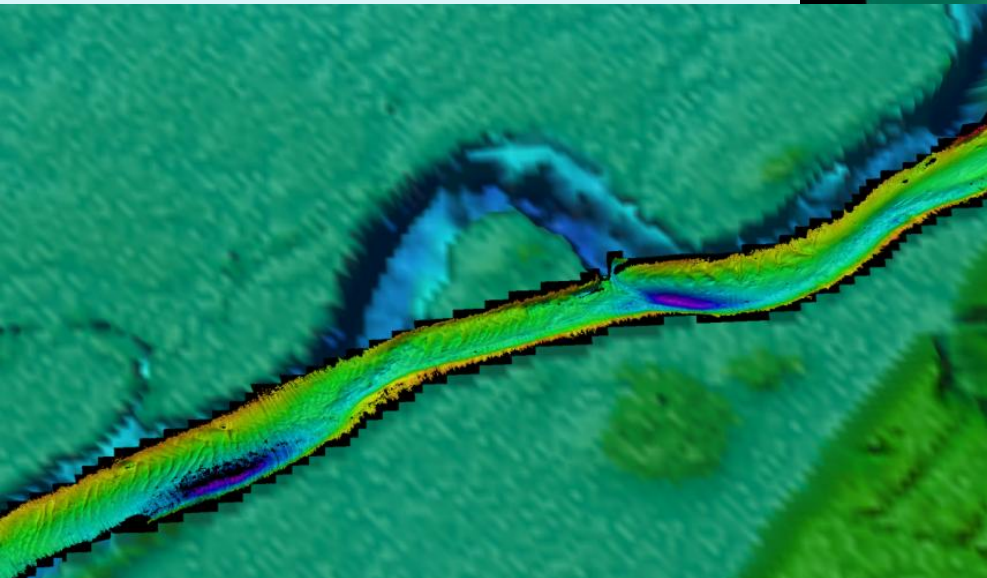
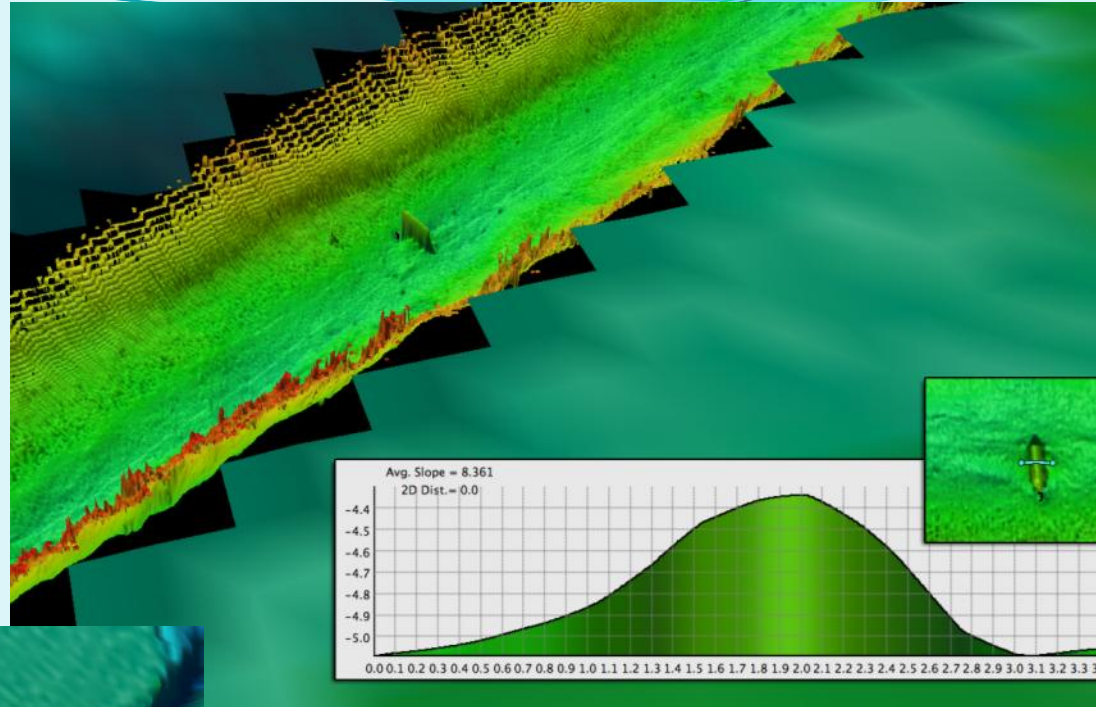


Fall 2009



Shoaling, Habitat and Bottom Boundary
for Improved Flood Modeling of Waterway/River System

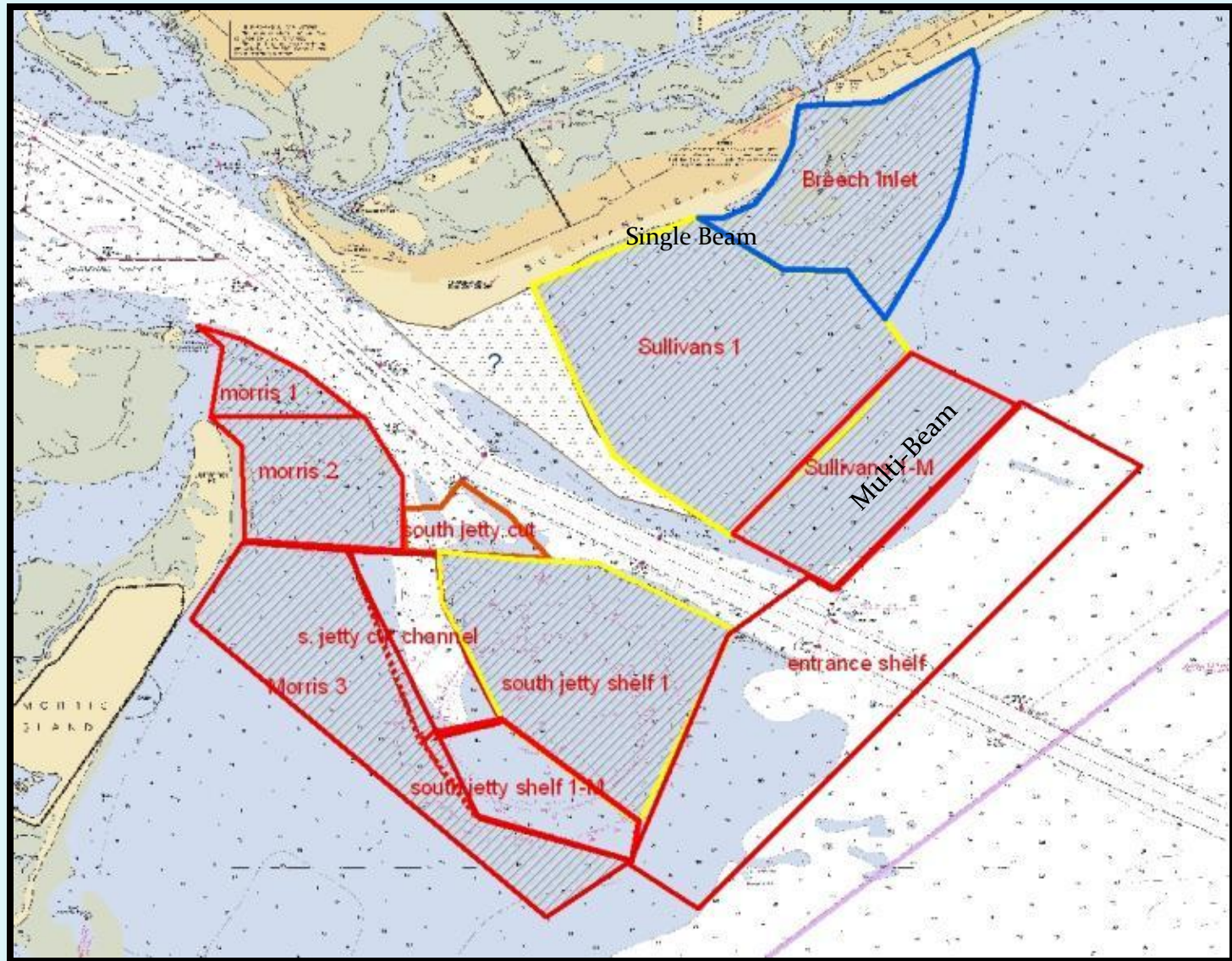
RSM-Establish Reference Surface
Time Series in Key Locations
Integrate hydrodynamic modeling



Bedforms -Boundary Roughness



US Army Corps of Engineers-Regional Sediment Management (RSM) Detailed Comprehensive Baseline -CHARLESTON HARBOR



Single
Beam

Planned-Winter 2009

SUMMARY

Many Critical Resource Management Issues Are Located in Shallow Water
Shallow Water Mapping Can be Completed but Can Also be Challenging

Maximize use of Platforms- Data Types
As Possible Continuous Coverages for Baseline
Seamless Across Beach to Traditional Subaerial Imagery/Mapping

Coastal Erosion Model
Framework/Behavior/Process Modeling
Regional Approach

Federal / Local Partnerships

Organizations such as USGS – Excellent Regional Sea Floor Mapping Capabilities
Very Shallow – Day Trips / Scheduling / Time Series
Can Benefit from Local/State Partners



BEACH CAM

